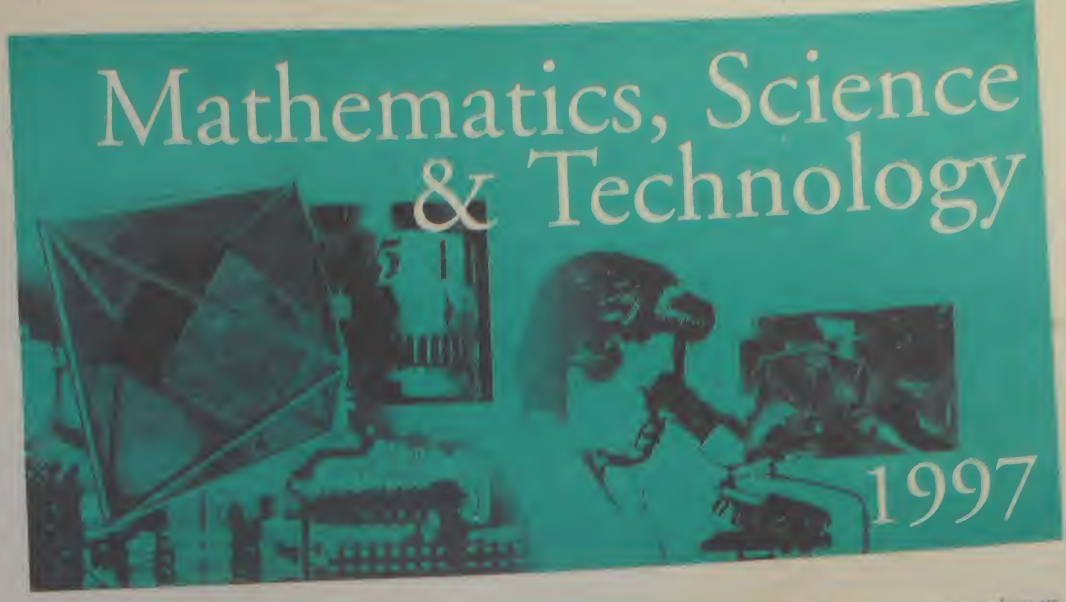
The Open University

Mathematics, Science & Technology



1997

INTRODUCTION

This is one of a set of three guides describing courses that can count towards the University's BA and BSc degrees and undergraduate-level diplomas. The guides each cover one main subject area:

- Arts and Languages
- Social, Educational and Business Studies
- Maths, Science and Technology

The University-wide interdisciplinary 'U' courses are included in areas in which they are most likely to be of interest. As well as detailed descriptions of the courses, the guides offer overviews and lists of related courses provided by the University's academic units to help you to plan your degree studies.

If you would like some preparation before you undertake a science course, there is an *Into science* study pack that might be a suitable choice. There are also study packs in the areas of development studies, environment studies and digital telecommunications.

STUDY PACKS

Study packs give you access to Open University materials without having to take exams or submit written work to tutors. They are self-contained and you can work through them at your own pace, alone or in a group. The materials in study packs vary greatly. Some consist mainly of printed text, others include audio or video cassettes or software. Some packs have different versions for individuals and for groups. The study packs in this guide are described on pages 35 and 53.

How to order

You can order study packs by phoning our credit and debit card hotline, 01908 652185 (653338 after office hours). We accept Access, Visa, Mastercard, Switch and other debit cards. You can also contact us on fax number 01908 655072.

If you want to pay by cheque or postal order please write to:

The Learning Materials Sales Office
PO Box 188
The Open University
Milton Keynes
MK7 6DH

If you are buying study packs on behalf of an organization you can ask to be invoiced.

Prices in this guide are for 1996 only; if you are buying in 1997 please ask about possible increases. All materials are sold subject to the Open University's standard conditions of sale, which you can get from the Learning Materials Sales Office.

Information you give us when making a purchase will be held on computer in accordance with the Data Protection Act 1984 (see our conditions of sale for details).

Discounts

There are discounts for multiple purchases of some packs; please ask for details.

Financial assistance (UK students only)

If you have a low income or are receiving state benefits, the Open University may be able to offer a financial award so that you can buy study packs at reduced prices. Please ask if you want to know more about this.

COURSES

You can if you wish take any of the courses in this guide without registering for a qualification. Courses are listed within each subject area according to their level; levels are explained in *BA and BSc degrees* on page 2. If you want to start your OU studies with a course at Level 2 or above, you should pay particular attention to the *Advice for applicants* in the course descriptions.

Tuition and counselling

If you register for a course you will have a tutor with whom you can keep in touch by correspondence or perhaps by telephone, who will help you with the course material and mark and comment on your written work. We may also be able to offer group tutorials or day-schools, perhaps run by your tutor, and you are encouraged, but not obliged, to attend them. Where your tutorials are held will depend on the distribution of students taking your course. If the place or time of tutorials is likely to affect your decision whether to register, you can get more information from your Regional Centre.

Residential schools

Some courses have a residential school that you must attend. Most schools are a week long and held in the summer on other UK university campuses. They include seminars and tutorials; field, laboratory and library work; projects; informal discussions and social activities. They give you a chance to immerse yourself in your course and to meet other students. *Residential school fees (£199 for one-week schools in 1996) are not included in the course fee.* You can be excused attendance if you have good reason, and your Regional Centre will advise you about this. Residence outside the UK is not in itself sufficient reason to be excused.

Assessment

All courses require you to produce written work (assignments) that your tutor marks and comments on. Some courses set work, usually multiple-choice questions, that is sent to the University for checking by computer. Most courses have a three-hour written examination at the end. You can choose not to take the exam if you are not interested in using your studies to obtain a qualification. External examiners from other educational institutions ensure that Open University awards are comparable with others in the UK.

Fees

Fees for courses in this guide are:

	UK	*Republic of Ireland*	*Other EU countries*
30-point Level 1 course	£150	+£146	+£270
Other 30-point courses	£160	+£146	+£270
60-point Level 1 course	£300	+£193	+£340
Other 60-point courses	£320	+£193	+£340

If you are studying outside the EU there may be a further charge for tuition because some of our courses benefit from government subsidy which is restricted to students in the EU. You will be given full details of fees when you make a reservation.

For information about payment methods and possible sources of help with fees, please see the *Courses, Diplomas and BA/BSc Degrees* brochure or, if you are a continuing student, your student handbook and its supplements.

While every effort is made to ensure accuracy, this information is subject to alteration in the light of changes in regulations or University policy, or financial or other constraints.

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Radio and television

Many courses include BBC radio and television programmes, others have cassettes as well or instead. If you miss a broadcast you may be able to borrow cassettes from the University's Broadcast Programme Loan Scheme, and information about that will be sent to you in your first batch of course materials. You can see and hear the broadcasts before you apply to join the University; details are given in *The Times Higher Educational Supplement* and publications such as *Radio Times*, *TV Times* and some newspapers. If you are studying outside the UK you will be sent cassettes of any radio or television programmes that are part of your course.

Computing

More and more courses require you to have access to a personal computer. The kind of computer you will need depends on the course, and we will send you the necessary information when you make a reservation. Please ask your Regional Centre (see page 56) if you want information before you make a reservation.

Studying outside the UK

You will find information about studying outside the UK in the *Courses, Diplomas and BA/BSc Degrees* brochure. You can also ask the appropriate Regional Centre or enquiry service listed on page 56.

For the future

Course descriptions will tell you if a course ends in 2000 or before and is not likely to be replaced by another in the same subject area. This information may change, but is there to help you if you are planning to continue your studies beyond 1997. A few courses are not available every year, and we have tried to give you an idea of when we will be offering them again.

Recognition of Open University courses by other institutions

Some courses can help you to gain admission to other institutions of higher education. The University awards credit for its courses in accordance with the Credit Accumulation and Transfer Scheme (CATS) that has been widely adopted in England and Wales. This scheme, like the related schemes for Scotland and for Europe, is a means of transferring credit between different institutions and programmes of study in higher education, and it enables you to compare the credit values of OU courses with those of other UK education institutions. If you transfer your credit to another institution, the number of points you will be able to count towards your new programme of study will depend on the requirements for that programme and on the relevance of your Open University study to it. It may not be the full amount.
If you want to obtain a professional qualification, credit for your Open University study might count towards membership of a professional institute or exempt you from a qualifying examination. We tell you about some of the possibilities in the individual course descriptions.

Reserving a place

All the courses in this guide start in early February 1997, with reservations closing on 30 September 1996.

New students

Please use the reservation form in the *Courses, Diplomas and BA/BSc Degrees* brochure or contact your Regional Centre.

Continuing students

A reservation form should be included with this guide. If not, please ask your Regional Centre.

Information and advice

We have advisory staff in our Regional Centres and OU Co-ordinators in other parts of Europe who will help with questions that you would like to discuss. We can offer advice about such matters as choosing courses, preparation, study arrangements or difficulties, tutorial support and financial support. If you have a query, however small, please get in touch as soon as possible so that you can be fully informed before you reserve a place and any help you need can be arranged before you commit yourself. You will find addresses and telephone numbers at the end of this brochure.

DIPLOMAS

The University offers several diplomas that you can obtain by completing specified combinations of undergraduate-level courses. You can take these diplomas either on their own or on your way to a degree. In this guide you will find details of:

- Diploma in Economics
- Diploma in Mathematics
- Diploma in Population Studies
- Diploma in Environmental Studies and Development

The *Social, Educational and Business Studies* guide gives details of:

- Diploma in Applied Social Sciences
- Diploma in Gender and Development
- Diploma in Psychology (conversion for postgraduates)
- Diploma in Health and Social Welfare
- Advanced Diplomas in Education (Part A courses only)
- Professional Diploma in Management

The *Arts and Languages* guide includes:

- Diploma in European Humanities
- Diploma in Music
- Diploma in French
- Diploma in German

It has not usually been possible for the guides to mention discontinued courses that count towards a diploma. If you have credit for a discontinued course in the area covered by a diploma, please ask your Regional Centre whether it can count. If it can, the Centre will be able to make the appropriate link on your record. Remember that you cannot count the same course towards more than two separate qualifications. (Qualifications that are related in a single hierarchy are not considered to be separate for this purpose.)

BA AND BSC DEGREES

Unlike other universities, where students are admitted to study for a particular degree, the Open University allows you almost complete freedom of choice in selecting your courses. You need not say in advance which degree you are aiming for. This allows you to study in areas of personal interest, which may develop and change as your studies continue, or to pursue career needs, which for mature students may be in surprisingly diverse subject areas. The degree you get will depend on the balance of courses you have taken; it is quite possible to gain a BSc degree that includes several courses in the arts, or to obtain a BA that includes science courses.

BA or BSc

Each course has a designation to show which degree it is particularly suitable for. A course designated A will weight your degree towards a BA, a course designated S will weight it towards a BSc. A course designated E is equally suitable for either. As a general rule, if you want a BSc you must include at least 180 points from courses designated S or E. If you want honours, at least 60 of these must be at Level 3. For a BA degree, you need at least 180 points from courses designated A or E, and for honours at least 60 of these must be at Level 3.

Points

For a BA or BSc you must obtain at least 360 points from OU courses or from a combination of OU courses and transferred credit (see below). This is equivalent to studying full-time for three years. A 30-point course takes about seven hours' study a week.

Levels

Undergraduate courses are at three levels:
Level 1 is equivalent to first-year study at any other UK university
Level 2 is equivalent to second and third-year study towards an ordinary degree at any other UK university
Level 3 is equivalent to the final year of an honours degree at any other UK university
To obtain an ordinary degree from the OU you need at least 240 points from courses at Level 2 or Level 3. The other 120 points can be from Level 1, Level 2 or Level 3.
The University also awards honours degrees. For these you need at least 120 points from courses at Level 3. Both Level 2 and Level 3 courses count towards the classification of your degree – first class, upper-second, lower-second or third class – but Level 3 courses carry more weight.

Planning your studies

Although you are free to register for a course at any level, we believe that most students will benefit from starting at Level 1. Level 1 courses are not a preliminary to undergraduate-level study but very much part of the degree itself. They help you to develop good study habits and general learning skills as well as introducing the special requirements of part-time study and the University's unique multimedia teaching system. Students on these courses are given more help with preparation and more tutorial and counselling support than is available on most other courses; there are also more tutorials at a wider choice of places. Level 1 courses provide the broad base of subject preparation that many Level 2 and Level 3 courses assume you have had. Our faculties and schools have built up programmes of courses with a structured progression between levels in each subject area, so if you do not follow the suggested routes you are strongly advised to find out what will be required of you before you commit yourself.
Because it is easy to underestimate the time and commitment needed for open-learning part-time study, we strongly recommend that you take not more than 60 points' worth of courses in your first year. As you become an experienced OU student you may decide that you can take on more. There is no time limit within which you must complete your degree.

Related courses

Open University courses are constantly being updated and renewed. Sometimes a course at one level will be replaced by another in the same subject area but at a different level; or the subject-matter previously covered by a 30-point course may be included in a new, expanded 60-point course; sometimes the treatment in the new course will be completely different. The new course will be given a different code and usually a different title. If there is substantial overlap in content between an old and a new course you will not be able to count both towards the same qualification. The individual course descriptions below will tell you about this.

Credit for previous study

If you have successfully completed courses of study at higher education level – *above* A-level, Scottish Highers, ONC, Abitur, baccalauréat or the equivalent – you can ask us to transfer credit for it to count towards your degree. The first 120 points of transferred credit will effectively count at Level 1, and any additional points will count at Level 2. You might want to take this into account when deciding how much Open University Level 1 study you want to do; you could find that you have more Level 1 points than you need. Transferred credit has no degree designation, so it is the points from your Open University courses that will determine whether you get a BSc or BA. (You must make sure that you have 180 points from OU courses that will qualify you for one degree designation or the other; it is possible to put together a combination of transferred credit and OU courses that amounts to 360 points but will not qualify you for *either* degree.)
There is a special kind of credit transfer for people who are moving to the OU after starting a degree with another UK institution of higher education (or one of the non-UK institutions that we recognize for this purpose). This kind of credit will exclude you from any OU course that substantially overlaps with the content of your previous studies.
An award of transferred credit can affect your choice of courses, so if you think you might be eligible we suggest that you read the leaflet *Credit Transfer for BA and BSc Degrees* carefully and take advice if necessary.

Mathematics and Computing

The Mathematics and Computing Faculty offers courses that are designed to meet a wide diversity of needs. Some courses expect no special mathematical knowledge when you begin and would make a valuable contribution to any study programme; others are more specialized courses in areas of computing, statistics and pure and applied mathematics that allow you either to concentrate in those areas or to complement studies that are primarily directed elsewhere.

Introductory maths courses

You have a choice of three 30-point 'entry' courses to begin your study of mathematics: MU120 *Open mathematics*, MST121 *Using mathematics* and MS221 *Exploring mathematics*. They share a common approach to mathematics and its study, and there is a natural progression between them, with a planned development of the skills you need to acquire. They offer a good preparation both for those who intend to study mainly mathematics courses and for those whose plans lie predominantly in other areas.

Another possibility to begin your Open University mathematics is MS284 *An introduction to calculus*, which concentrates on mathematical principles and their application to physics. If you include MS284 in your degree you cannot also include either MST121 or MS221.

We begin with a summary of our recommendations, but please read the more detailed discussion that follows as well, since you will need to consider your own starting-point, how much time you want to spend on your study, and which courses you will want to take in the future.

Summary of our recommendations

- If you have a good mathematical background (beyond GCSE or O-level, in Scotland beyond SCE O Grade or Standard Grade), consider MST121 or, if you have plenty of time, MST121 and MS221 together.
- If you have less mathematical background or want a course that builds up skills and knowledge at a slower pace, consider MU120, whether you are thinking of taking further courses in mathematics or not.
- If your main interest is in science or technology but you need some mathematics, consider combining MU120, MST121 or MS284 with S102 or T102.
- If your main interest is in computing you could start your studies with any of MU120, MST121 or T102.

Your mathematical experience MU120 assumes that you come to it with only basic literacy and numeracy. MST121, MS221 and MS284 assume that you already have some mathematical skills,which you could gain from MU120. MU120, MST121 and MS221 offer more tutorial support than MS284. If you register for MU120, MST121 or MS284 we will send you a preparatory pack so that you can revise some mathematics before the course begins.

Combining introductory maths courses We advise you not to take MU120 and MST121 at the same time; you should take MU120 first. Similarly, if you want to take both MU120 and MS284 you should take MU120 first.

You should take MS221 only together with or after MST121. These two courses have been designed so that if you take them together your studies will be structured as a single 60 point course, rather than two separate 30-point courses. But you can, of course, take MST121 on its own and then follow it with MS221.

You could take another Level 1 course (A102, D103, T102, S102, L120) alongside any of the mathematics entry courses, but that would be a very heavy workload. You should seek advice from your Regional Centre if you are thinking of attempting more than 60 points in your first year of study.

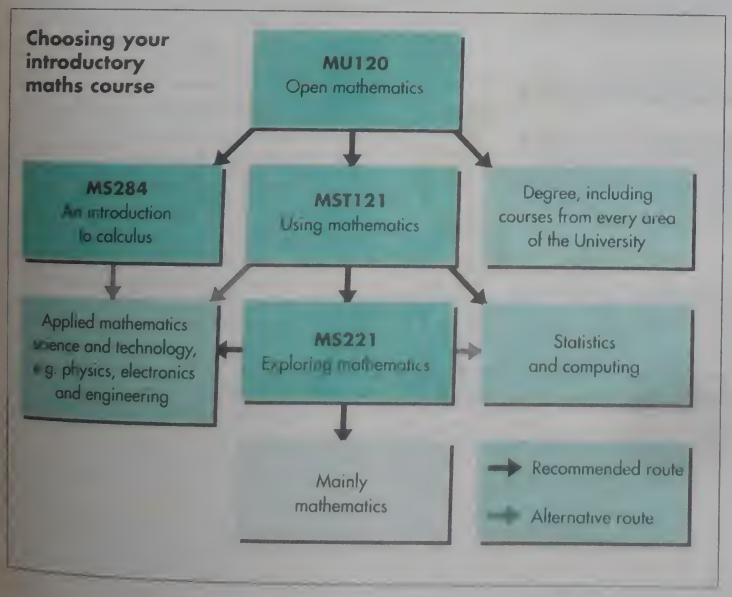
Your study plans in mathematics and computing If you intend to take higher-level mathematics courses such as MST204 *Mathematical models and methods* or M203 *Introduction to pure mathematics*, you are strongly advised to prepare yourself by taking MS221.

If your main interest is in computing, MST121 (or MST121 and MS221) is the best choice, though either MU120 or T102 *Living with technology* would be an alternative. If your main interest is in physics, it is advisable to include MS221 in your studies.

If your main interest is outside mathematics If you need only a limited amount of mathematics, perhaps for non-physical science courses, then MU120 might be sufficient for your needs. It could also be a good choice if you have already taken a science or technology foundation course (S102 or T102) but found the maths difficult and did poorly in it. MU120 introduces skills that you will need if you are to be an effective user of mathematics in science or technology: basic numeracy and the ability to interpret graphs and equations and to use a modern graphics calculator.

If you're going to take courses in areas that have a significant mathematical content (in electronics or engineering mechanics, for example), you should consider MST121 and possibly MS221.

If physics is your interest, MS221 will provide you with the necessary mathematical background, and will also allow you to include a large proportion of mathematical courses in your degree. Alternatively, MS284 will provide the necessary mathematical background for physics courses, but will restrict your choice of further mathematical courses.



For areas such as arts or social sciences, where no special mathematical knowledge is required, MU120 will give you numeracy skills that will enhance your studies. MU120, MST121 and MS284 also fulfil the mathematics requirement for initial teaching education and a Postgraduate Certificate in Education.

Higher-level courses

After your introductory course there is enough choice for you to be able to complete a degree in pure and applied mathematics alone. If you want to concentrate on computing you will find that combining courses produced by the Mathematics and Computing Faculty with some of those from the Technology Faculty may meet your requirements. Most of the computing courses can be taken without any mathematical background. Statistics can be included as a significant element of a broadly based mathematics degree.

Level 2

Pure and applied mathematics

If you want a degree with pure and applied mathematics at its centre we advise you to take, after MS221 *Exploring mathematics*, the two 60-point courses M203 *Introduction to pure mathematics* and MST204 *Mathematical models and methods*, in that order. M203 *Introduction to pure mathematics* offers an introduction to many of the basic areas of pure mathematics and the relationship between them. It will suit both those who do not intend to carry the subject further and those who are going on to courses in pure mathematics at Level 3. MST204 *Mathematical models and methods* is the central element of applied mathematics in any degree that concentrates on mathematics, engineering mechanics or physics. It is the best preparation for applied mathematics courses at Level 3 and for some physics courses. It will equip you with the tools and skills that you need in order to recognize and solve problems with a mathematical content, particularly those that arise in science and technology.

After these courses you can either broaden your studies or attempt some specialization. To broaden your degree you could choose further courses at Level 2.

Statistics

M246 *Elements of statistics* is the principal introductory course in the subject, leading on to Level 3 courses in probability and in statistical methods. It gives an introduction to statistical software, so you will need a personal computer. To be well prepared for it we recommend MST121 *Using mathematics* or MS284 *An introduction to calculus* (the discontinued courses M101 or MS283 would serve equally well, if you have taken either of those.)

MDST242 *Statistics in society* complements M246 by presenting statistics in the context of everyday problems. The approach is less mathematical than that of M246 and no particular courses are recommended to precede it. It concentrates on applying statistical ideas and interpreting statistical results.

Computing

M205 *Fundamentals of computing* requires no special preparation, but it is more than a general awareness course. It is itself recommended before you go on to courses at Level 3, laying a firm foundation for further study of computing. You will be expected to spend two to three hours each week on practical work with a personal computer.

M261 *Mathematics in computing* complements M205 by introducing some mathematical ideas necessary for a formal approach to computing, though unlike M205 it does not include practical computing. It is for students who intend to specialize in computing, but essentially it provides a 'pure mathematical' view of the subject and so is of interest to pure mathematics students too. It is the best preparation for M355 *Topics in software engineering*, as well as providing valuable background for the other computing courses at Level 3. We recommend taking it after MST121 *Using mathematics*, MS221 *Exploring mathematics* or MS284 *An introduction to calculus*. (The discontinued courses MS283 or TM282 would also serve, if you have taken either of those.)

Level 3

As part of a broad degree M365 *Graphs, networks and design* might be a good choice. It is a wide-ranging course, and one of the few at Level 3 that do not build on a specified course at Level 2. Its selection of topics should make it popular with teachers of mathematics as well as with people who are interested in applications of pure mathematics.

If you want to specialize by taking Level 3 mathematics, statistics or computing courses you are advised not to attempt a course at Level 3 unless either you have passed the recommended Level 2 course(s) with at least a Grade 3 and preferably a Grade 2 or Grade 1, or you are confident that you have acquired an equivalent background by other means.

Pure mathematics

The recommended Level 2 course to prepare for Level 3 in this area is M203 *Introduction to pure mathematics*.

The main pure mathematics courses at Level 3 are M336 *Groups and geometry*, M337 *Complex analysis* and M381 *Number theory and mathematical logic*.

There is also a 'suite' of more demanding pure mathematics courses, of which one is presented each year. They are on more advanced topics than the other Level 3 courses and require more mathematical background and experience, so it is advisable to take several other Level 3 courses before you attempt one of these. These courses are:

M434 *Differential geometry* (to be presented in 1997)

M435 *Metric and topological spaces and geometric topology* (to be presented in 1998)

M433 *Aspects of abstract algebra* (to be presented in 1999)

M431 *The Lebesgue integral* (to be presented in 2000)

Applied mathematics and mathematical physics

The recommended preparation for this area is MST204 *Mathematical models and methods*.

The applied mathematics courses at Level 3 are presented in alternate years. MST322 *Mathematical methods and fluid mechanics* and M372 *Numerical methods for differential equations* are offered in odd-numbered years. MS323 *An introduction to non-linear dynamics* and M371 *Computational mathematics* in even-numbered years. M371 and M372 require extensive use of a personal computer, though no programming is included. Other courses relevant to this area are described in other sections of this guide; they include SM355 *Quantum mechanics*, SMT356 *Electromagnetism* and S357 *Space, time and cosmology*.

Statistics

The recommended preparation in this area is M246 *Elements of statistics* (or the discontinued M245, if you have taken that).

The Level 3 course in statistics is M343 *Applications of probability*, which develops your expertise in the use of probability for modelling real situations such as changing populations, sizes, queueing systems and epidemics.

Computing

The recommended preparation here is M205 *Fundamentals of computing*.

The three computing courses at Level 3 are M353 *Programming and programming languages*, M355 *Topics in software engineering* and M357 *Data models and databases*. You will need a personal computer for M353 and M357, but not for M355. M355 is relatively mathematical in character and builds on M261 *Mathematics in computing* and, preferably, M353 *Programming and programming languages* as well as M205.

The computing courses at Level 3 lead to a suite of computing projects: M453 (based on M353), M455 (based on M355) and M457 (based on M357). You can include only one of these projects in your degree, and you are strongly advised to obtain first a Grade 1 or 2 in the corresponding course. It is better to prepare

yourself by completing two or, ideally, all three. The number of places we can offer for the computing projects may be limited.

Master of Mathematics degree

This new degree, made up of undergraduate-level courses, is for students who want a degree with greater mathematical depth or breadth than can be achieved in the 360-point honours BA or BSc. For the award of the MMath degree you need 480 points including 360 from an approved list of mathematics and physics courses. At least 240 of these points must be at Level 3. Approved mathematics courses are marked MM on the diagram below; the physics courses that can count towards the MMath are SM355 *Quantum mechanics* and SMT356 *Electromagnetism* (see page 24).

DIPLOMAS

Diploma in Mathematics

You qualify for the undergraduate-level Diploma in Mathematics by passing M203 *Introduction to pure mathematics* and MST204 *Mathematical models and methods*. You might want to obtain the diploma on your way to a BA, BSc or MMath degree.

Diploma in Computing

This undergraduate-level diploma is for anyone who has an interest in computing, though it may be of special interest to you if you are studying for career development purposes. You need 120 points for the diploma; 60 come from M205 *Fundamentals of computing*, the only compulsory course, and the rest from your choice from the following 30 point courses. You must include one Level 3 course:

M261 *Mathematics in computing*

M353 *Programming and programming languages*

M355 *Topics in software engineering*

M357 *Data models and databases*

T223 *Microprocessor-based computers* (described on page 39 in the *Technology* section)

Although you can take the courses in any order, we advise you to take M205 first. We also recommend that you take M261 before M355.

Postgraduate study

The Faculty also offers courses at postgraduate level, with an MSc in Mathematics and both a Postgraduate Diploma and an MSc in Computing for Commerce and Industry. If you would like to know more about these, please ask for the appropriate brochure (see page 55).

Recognition by professional bodies

Certain combinations of mathematics courses are regarded by other institutions as equivalent to an honours degree in mathematics, for example for the purpose of recognition as a graduate of the Institute of Mathematics and its Applications. Open University graduates who include specified courses in their degree may be exempted from Part 1 of the professional examinations of the British Computer Society. The individual course descriptions tell you a little more about these possibilities.

A note for teachers

The broadly-based degree outlined above might well suit a mathematics teacher working with pupils aged from eleven to eighteen, while those who concentrate on teaching sixth-form pupils might specialize in one or two of the four main areas described earlier and consider going on to take an honours degree. MU120 *Open mathematics* is likely to be particularly useful for teachers at all levels and can be counted as the mathematics prerequisite for the Open University PGCE. MA290 *Topics in the history of mathematics* provides useful background knowledge for those teaching mathematics, especially in secondary schools.

RELATED COURSES IN MATHEMATICS AND COMPUTING

Mathematics education

Computing

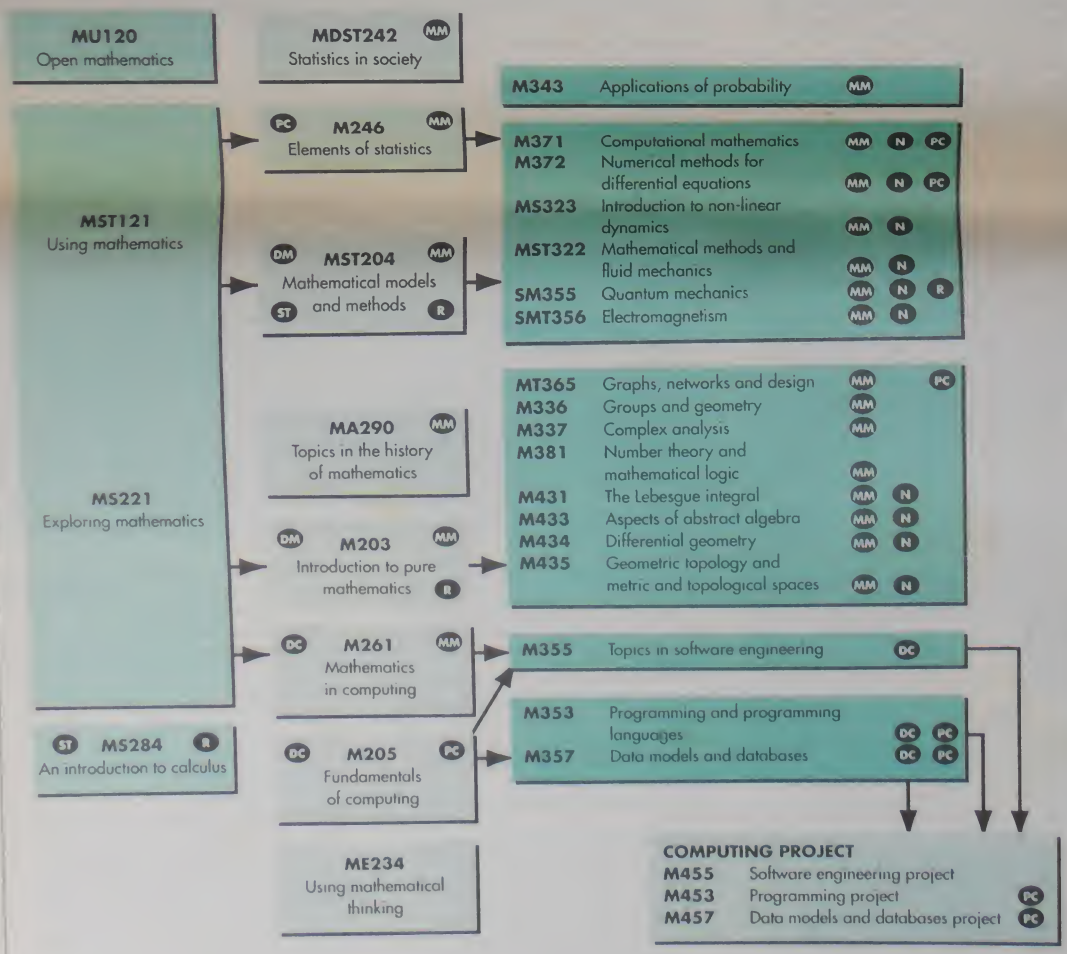
M205, M261, M353, M355, M357 and T223 can contribute to the Diploma in Computing.

Pure and applied mathematics

M203 and MST204 together make up the Diploma in Mathematics.

Statistics

Suggested routes in mathematics and computing



Key

→ Study route through the Faculty's courses
PC Requires a personal computer
R Has a residential school
ST Please read *If your main interest is outside mathematics* on page 3
N Not presented every year
DC Counts towards Diploma in Computing
DM Counts towards Diploma in Mathematics
MM Counts towards MMath

MU121

USING MATHEMATICS

This is a 30-point course at Level 1, with an residential school.
It requires a personal computer.

The course

This is one of three courses that offer an enjoyable and flexible means of entry to university-level mathematics. They will suit you whether you intend to concentrate mainly on mathematics courses, or to study other subject areas.

Using mathematics provides a broad introduction to the nature of mathematics and its uses in the modern world. It shows how mathematics can be used to investigate and answer questions from science, technology and everyday life. To do this the course introduces a range of powerful ideas, with particular attention to discrete mathematics (including matrices, calculus and statistics).

The course introduces the use of computer software to help you in doing mathematics. This is an integral part of its approach, so you will need regular and convenient access to a suitable personal computer. The software greatly increases the speed and accuracy with which mathematical manipulations can be performed, and so enhances your ability to apply mathematical techniques to the investigation and solution of practical problems.

The course begins with *Getting to know Mathcad*, a free-standing first exploration of the main software package to be used. The rest of the course is in four blocks, each divided into chapters.

Block A *Modelling with mathematics* comprises four chapters. The first two, *Modelling the physical world* and *Modelling growth* start from situations in the natural and designed worlds that can be modelled by sequences of numbers. The mathematical properties and representations of arithmetic and geometric sequences are then examined. *Representing circles* is about the properties of circles and related shapes and how these properties are used in the interpretation of natural phenomena and the design of material objects. This leads into mathematical representation of such shapes using different co-ordinate systems. The fourth chapter, *Modelling with functions*, looks at the properties of functions such as x^2, $\sin x$, $\cos x$ and $\exp(x)$ and uses these properties in further modelling contexts.

Block B *Discrete models* starts with a chapter on *Functions and calculations* that emphasizes the importance of precision in algebraic notation. It examines ways of making sure that calculators and software perform the required operations, and introduces ideas such as expression trees and the trace of an algorithm. *Modelling with sequences* builds on the earlier work on sequences to develop population models and investigate their long-term behaviour. The third chapter, *Modelling with matrices*, introduces the arithmetic of matrices and vectors and uses it to extend the work on population models to examine the interdependence of sub-populations of different ages.

The mathematical theme of the third block, *Continuous models*, is calculus. *Differentiation and modelling* introduces the idea of the derivative of a function and relates it to the idea of instantaneous rate of change. Standard derivatives are obviated for the functions first met in *Modelling with functions* in the first block and are used to model motion and in optimization problems. The next chapter, *Integration and modelling*, starts by looking at integration as the inverse of differentiation, then intuitively as the limit of an infinite sum. A bank of standard integrals is obtained and applied to solving simple differential equations and to finding areas. *Finding a function for a model* consolidates the work of the block by using many of the continuous functions met earlier in the course to model various physical and social contexts.

The last block, *Modelling uncertainty*, is concerned with probability and statistics. *Chance* invokes intuitive ideas of randomness and adds to your experience of thinking about probability by using software simulations. The second chapter, *Modelling and variation*, sees how probabilistic situations can be modelled with the support of statistical software. Two short chapters, *Estimating* and *Comparing*, engage you in some independent investigation using statistical ideas, and this is developed further in the chapter *Looking for relationships*.

The effective application of mathematics to solving problems ('mathematical modelling') requires skills beyond mathematical technique and the course also develops these such as identifying and defining problems and communicating the results of your mathematical work.

Advice to applicants

This courses assumes that you already have some mathematical knowledge:

- Properties of triangles (trigonometry and Pythagoras' theorem), rectangles and circles.
- Arithmetic of whole numbers, decimals and fractions.
- Basics of algebraic manipulation, such as expansion or factorization of expressions, interpreting inequalities and solving equations.
- Use of statistical measures such as mean and mode.
- Functions such as quadratic, exponential and sinusoidal.

If much of this is unfamiliar you should consider taking MU120 *Open mathematics* first, but if all you need is a reminder of some of these topics, you can use the MST121 preparatory materials to revise them.

MST121 is part of an entry suite of courses that also includes MU120 *Open mathematics* and MS221 *Exploring mathematics*. You can take one, two or all three courses from this group. Your choice will depend on how much mathematical knowledge you already have and on the degree you have in mind. Please ask your Regional Centre for the leaflet *Mathematics Choices*, or for more advice about choosing the most suitable mathematics entry course.

Preparatory work

A few weeks before the course begins we will send you a set of preparatory packages consisting of mathematical revision material (based on MU120 *Open mathematics*) and a quiz to help you judge how much preparation you need. There will also be information about the type of personal computer you will need, and an introduction to using it.

If you are disabled

We are trying to make the course materials accessible to everyone. Printed material will be recorded on audio cassette, and we intend to make transcripts of television programmes, video and audio cassettes available. Work with a personal computer is an essential part of the course, so if that might be difficult for you please consult the Adviser to Students with Disabilities at your Regional Centre. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Fifteen study texts grouped into four blocks, each with an associated computer book

Broadcasts and cassettes
Sixteen television programmes (these are for the whole suite of mathematics entry courses)
Video cassettes
Audio cassettes

Software
All the software you need will be supplied.

You will need

Television
Video cassette player (VHS)
Audio cassette player
A scientific or graphics calculator (the calculator used in MU120 will be suitable).
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre). If you want to participate in the *optional* electronic conferencing with other students and tutors, you will need a modem.

Assessment

There are four tutor-marked assignments, three computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MST121 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of MST121 overlaps with MS284, and with the discontinued courses M101, M100, MS283, TM282 and TM281, you can count only one of these courses towards a BA or BSc.

Vocational qualifications
This course can contribute to the award of a National or Scottish Vocational Qualification; it develops skills in communication, problem-solving, application of number, information technology and developing one's own learning, as defined by General National Vocational Qualifications Level 4. We will send you more information if you register for the course.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body, and can be accepted as an entry qualification in mathematics for admission to a postgraduate certificate in education. You can find out more in our Recognition Information leaflets:

1.1 *Particular careers: teaching: training and salaries (England, Wales and Northern Ireland)*
1.2 *Particular careers: teaching: training and salaries (Scotland)*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*

You can get these from your Regional Centre.

MU120

OPEN MATHEMATICS

This is a 30-point course at Level 1.
It has no residential school and requires no computing equipment.

The course

This course will help you to make mathematical thinking part of your common sense and build up your confidence in using it. The course is about the relationship between mathematics and the world in general and assumes only basic literacy and numeracy. You are *not* expected to have any algebraic skills.

The course will be of interest to students with a variety of concerns and study plans. The skills it introduces will be valuable to those who intend to specialize in mathematics courses, even if they have met the mathematical concepts and techniques before, and it is also suitable for all those who will be users of mathematics, whether they intend to concentrate on courses in science, technology or social science. It offers an introduction to mathematics and its uses that is of interest in itself, even if you undertake no further study or use of mathematics. (But once you've done it you'll find mathematics so fascinating that you'll want more.)

The course looks mathematically at a variety of fields including health, music, art, maps, motion, rainbows and everyday economics, and examines general questions like whether people are getting better off in relation to income and prices. Among the mathematical ideas are statistical, graphical, algebraic and numerical concepts and techniques. It also introduces mathematical modelling and looks at the interpretation of slopes or gradients of graphs but leaves formal calculus techniques to MST121 *Using mathematics*.

Another strand of the course is the development of widely applicable skills such as communication, problem-solving, developing your own learning and the application of number. You will also learn how to use a graphics calculator, which is provided with the course materials.

There are sixteen texts, roughly one each two weeks:

- Mathematics everywhere
- Prizes
- Farming
- Health
- Seabirds
- Maps
- Graphs
- Symbols
- Music
- Predictions
- Movement
- Growth and decay
- Baker's dozen
- Space and shape
- Repeating patterns
- Rainbow's end

Advice to applicants

This course is part of an entry suite that also includes MST121 *Using mathematics* and MS221 *Exploring mathematics*. You can take one, two or all three courses from this group; your choice will depend on how much mathematical knowledge you already have and on the degree you have in mind. If you are not sure which course(s) to take please ask your Regional Centre for the leaflet *Mathematics Choices*, for self-diagnostic quizzes for MU120 and MST121, and for further advice about your choice.

Preparatory work

Preparatory materials will be sent to you several months before the course begins. If you want to do some further reading, *Countdown to Mathematics* Volume 1 by L. Graham and D. Sargent or *Basic Mathematics* by Alan Graham would be helpful.

If you are disabled

We are trying to make the course materials accessible to everyone, and a projection screen for the graphics calculator is available. Course material will be recorded on audio cassette, and we intend to make transcripts of television, video and audio cassettes available. If you can't press calculator keys or read the display, even if projected on to a large screen, you will need a helper for about one hour each week. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts
Course guide
Learning file
Resource book
Calculator book
Offprint collection
Graphics calculator

Broadcasts and cassettes
Sixteen television programmes (these are for the whole suite of mathematics entry courses)
Two video cassettes
Five audio cassettes

You will need

Television
Video cassette player (VHS)

Assessment

There are five tutor-marked assignments and five computer-marked assignments. The first tutor-marked assignment and the first computer-marked assignment will not count towards your course result. Instead of an examination there is a consolidation assignment based on your study of the whole course; you complete this at your usual place of study, not at an examination

centre. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MU120 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of MU120 overlaps with the discontinued course M101, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body, and can be accepted as an entry qualification in mathematics for admission to a postgraduate certificate in education.. You can find out more in our Recognition Information leaflets:

1.1 *Particular careers: teaching: training and salaries (England, Wales and Northern Ireland)*
1.2 *Particular careers: teaching: training and salaries (Scotland)*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*

You can get these from your Regional Centre.

M203
INTRODUCTION TO PURE MATHEMATICS

This is a 60-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course gives you an introduction to some of the principal areas in pure mathematics, and to the relationship between them. It uses a geometric approach to the various topics to enable you to 'see' what is going on, and to give you a feeling of the true unity of the subject. The course is suitable both for those who do not intend to carry the subject further, and for those who want to go on to higher level courses in pure mathematics.

Introduction
The introduction to the main areas covered by the course raises many questions that will be answered later.
Curve sketching A reminder of the principles underlying the sketching of graphs given by equations $y = f(x)$ or curves in parametric form, and of some of the basic functions on the real line.
Symmetry You will investigate symmetries of objects in two and three dimensions, including the five 'regular' solids. This leads to the definition of a 'group'.
Plane geometry Largely concerned with the Euclidean geometry of the plane. Cartesian co-ordinates are used as an introduction to vectors and to study conics. The algebra of lengths and angles is introduced using the dot product, and complex numbers are discussed.
Groups and sub-groups Initially from a geometric viewpoint, we introduce the ideas of cyclic groups, isomorphisms between groups, and subgroups.

Linear algebra
This block shows how co-ordinate geometry leads to a close connection between the geometry of lines and planes and simultaneous equations. This requires the introduction of vector spaces and their dimensions, linear transformations between them and their representation as matrices. The emphasis at the beginning is on the plane and 3-space but all the ideas are developed for the more general case of higher and even infinite dimensional spaces.
Linear independence and bases A precise algebraic method of describing why we think of the plane as two-dimensional and space as three-dimensional.
Matrices Matrices are arrays of numbers used to represent functions between vector spaces and do calculations on them. The determinant of a matrix is introduced in order to investigate the invertibility of matrices, leading to a brief look at matrix groups.
Linear equations The relationships between linear equations, matrices and their invertibility, and geometry.
Eigenvectors The diagonalization of matrices, a fundamental mathematical idea used in almost every branch of mathematics.
Vector spaces We show the generality of the ideas we have developed and introduce many diverse examples to which they can be applied; some of these are used later in the study of differential equations.

Analysis (A)
This block studies the detailed structure of the real line and functions defined on it, especially those that do not distort the detailed structure too much. This leads to a precise definition of concepts that you met earlier in your study of calculus.
Numbers What we mean by a 'real number', using the decimal representation approach. We also discuss the rational and irrational numbers, and inequalities between real numbers.
Sequences The 'null sequences' approach is used to make rigorous the idea of a sequence converging. Using the monotone convergence theorem we discuss the numbers *pi* and *e*.
Series As a particular application of the theory of sequences we examine the convergence and absolute convergence of series of real numbers and use series to define the exponential function.
Continuity Using sequences we investigate continuous functions, and prove the boundedness theorem and intermediate value theorem.
Limits The convergence of sequences is used to study the limits of functions at finite points and at ± infinity.

Group theory
This block moves on from the introductory study of particular groups to an examination of the more abstract idea of groups. We also study the general properties and internal structures of groups.
Permutation groups The idea of a permutation, the cycle decomposition of a permutation, odd and even permutations. This leads to a definition of conjugacy and to the discovery that every group is isomorphic to a permutation group.
Cosets Starting from the idea of 'blocking' a group multiplication table, we introduce the idea of cosets, normal subgroups and quotient groups. Cosets are also used to relate the numbers of elements in a group and any of its subgroups.
Homomorphisms We generalize the idea of an isomorphism to that of homomorphism and explore the properties of a homomorphism, which lead to a greater understanding of normal subgroups.
Group action How groups are related to geometry. The notion of group action is used to review ideas of coset and conjugacy and to count the number of different ways an object can be coloured.

Geometry
This block explores several different geometries and develops interesting features of some of them. This requires the introduction of the appropriate algebraic description and the group of transformations in each geometry.
Affine geometry The geometry of the plane under the group of invertible linear transformations and translations, a powerful tool for studying properties of conics.
Inversive geometry The geometry of lines and circles in the plane and its associated group, the group of Möbius transformations.
Non-Euclidean geometry A geometry based on distance but in which the parallel axiom of Euclid does not hold.
Projective geometry: lines A geometry that is not based on distance and angle but that has many uses in mathematics and painting. It generalizes the ideas of affine geometry. A second text deals with conics.

Analysis (B)
This block continues the study of analysis into areas already covered by calculus, but in greater depth and with far more powerful techniques (and more exciting results).
Differentiation After reviewing ways of combining differentiable functions we see how Rolle's theorem, the mean value theorem and the Cauchy mean value theorem lead to l'Hopital's rule.
Integration We outline a precise definition of what we mean by an 'integral' and we prove the fundamental theorem of calculus. Our idea of partitions is applied to the Maclaurin integral test and Stirling's formula.
Power series The interval of convergence theorem, different ways of finding power series and applications of them.
Differential equations and flows A study of second-order constant coefficient linear differential equations using the techniques of power series and linear algebra.
Proofs in analysis We fill in some of the gaps left earlier by the omission of difficult proofs. We also explain the important 'epsilon-delta' method of defining 'limit', 'continuous' and 'differentiable'.

Advice to applicants

This would be a most useful course for anyone who is teaching A-level mathematics or intends to do so, as it includes a lot of background on which A-level syllabuses are based. The course is *not* recommended for those who have little mathematical experience. It was written to follow the University's foundation course in mathematics, so it assumes that you have studied mathematics to roughly university-entrance standard. It is most important that you are familiar with sets and functions, with differentiation and integration and with both plane Euclidean and co-ordinate geometry. You will be even better prepared if you have met any of the following subjects before (but don't worry if you haven't): vectors, matrices, groups, differential equations, transformation geometry.

Preparatory work

If you feel that you need to revise the subjects described in *Advice to applicants* or you want to do some preparatory work, read some of the School Mathematics Project A-level textbooks. They contain plenty of exercises to get you used to doing mathematics. Even if you are very confident about your ability to undertake the course it is probably a good idea to work through some texts like these, as it will help you get used to regular study – remember that you will have to work up to a regular twelve hours a week. The Pelican book *Concepts of Modern Mathematics* by Ian Stewart offers a less specialized introduction to pure mathematics.

If you are disabled

You should be able to follow the course even if you cannot benefit fully from the television and audio cassette based sections, as there are transcripts of the broadcasts and cassettes. There are no recordings of printed course materials because the course is being gradually rewritten. You might have difficulties at the residential school, but helpers can be provided. Please ask your Regional Centre for our booklet *Meeting your Needs* if you haven't already got it.

Course materials

Printed material
Preliminary booklet *Sets and Functions*
Twenty-nine course texts

Broadcasts and cassettes
Twenty-nine television programmes
Nine audio cassettes

You will need

Television (preferably colour)
Audio cassette player

Residential school

A one-week summer school. The fee for this (£199 in 1996) is not included in the course fee.

Assessment

There are eight tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M203 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It is also part of the University's Diploma in Mathematics and MMath degree.

Related courses
Because the subject-matter of M203 overlaps with the discontinued courses M202, M211, M212 and M231, you can count only one of the five towards a BA, a BSc or a diploma.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Analysts and Programmers or the Institute of Hospital Engineering. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

M205
FUNDAMENTALS OF COMPUTING

This is a 60-point course at Level 2, with no residential school.
It requires a personal computer.

The course

This course offers much more than a broad awareness of computing and computers. It lays foundations for the further study of specialist topics in computing including advanced programming and programming languages, computer architecture and operating systems, databases and topics in software engineering. From our experience with this course and its predecessors we believe that we can make some confident predictions about the people who will take it. We expect our students to include a significant number of young managers whose jobs will bring them into contact with computer and who are likely to be asked to assist in investigating and developing a new use of a computing system. The course will equip these students with the knowledge and understanding of computing they will need if they are to contribute fully to such a project. We cannot teach the details of the many available commercial computing systems but, by concentrating on the principles that all of them follow, we can enable these students to apply their learning to their own work.
The course will also attract people employed in the computing profession who want to broaden their knowledge of the subject. The course will not advance their expertise in their particular specialities, but it will give them the chance to learn about many other branches of computing. Thirdly, we expect that teachers, mainly but not exclusively in secondary education, will be among our students. The course gives an introduction to computing that goes considerably further than elementary programming. We use a structured approach to

program design, called 'top-down design'. The programs are implemented in Pascal, a language that is particularly suited to the teaching of structured programming.
If you are not in one of these professions, the course can offer you a sound understanding of the basic topics in the study of computing and the basis for a decision about what further studies in the field would be of benefit to you.
Computing requires the collection, organization, storage, processing and presentation of data. In order to use a computer to do any job it is necessary to decide exactly what the task is, to devise a method for performing it on the computer and to produce a sequence of instructions, a program, to carry it out. If programs are to be reliable and free from error, the analysis of requirements and the stages of designing the program must be well organized. The coding of the instructions in a language that can be executed on the computer is a relatively small part of the process of developing a program. The practical aspects of computing are so important that you will spend more than half yout time on this course learning about them.
The data handled by a computet usually consist of text and numbers, but may also include representations of pictures, signals from monitoring devices and so on. This is the raw material that a computer processes. It must be correct and complete if the computer is to do its job properly and must be sensibly arranged, or structured. The study of data structures is fundamental to this course.
Some scientific applications of computers require vast amounts of calculation using only small amounts of data, but most applications, particularly in commercial and business computing, are concerned with the organization and storage of large files of data and relatively little computation. The efficient organization of data records in files and the methods of accessing it in files and other kinds of information system is another important part of the course.

Advice to applicants

You are not expected to have any knowledge of computing before you begin, but if all you want is a general awareness course this is not a suitable choice. To get the full benefit from the course you must complete the practical work, which includes program design, implementation and testing. You will need the use of a suitable computer, and you will be expected to work with it for four or five hours a week throughout the course.

Preparatory work

If you have never touched a keyboard you could usefully spend some time making yourself familiar with its layout. If you would like to acquaint yourself with some aspects of Pascal we recommend the introductory chapters of either of:

D. Cooper, M. Clancy (1990) *Oh! Pascal!*, W. W. Norton and Co.

Elliott B. Koffman (1989) *Pascal*, Addison-Wesley

If you are disabled

As long as you can use a computer the course is not impossible, although there may be difficulties. Printed course materials are available on audio cassette. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six study texts
A study guide to the course
Notes to accompany the television ptogrammes
The p-system Pascal manual

Broadcasts and cassettes
Sixteen television programmes
One audio cassette

Software
Nine disks of software

You will need

Television
Audio cassette player
A computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are eight tutor-matked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M205 this rule can apply to one assignment. You will be given more detailed infotmation when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.
This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.
It is also part of the University's Diploma in Computing.

Related courses
Because the subject-matter of M205 overlaps with the discontinued course M252, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Analysts and Programmers or the British Computer Society. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

For the future

The course will be presented for the last time in 1997. It will be replaced by in 1998 by M206 *Interactive object computing.*

M205

ELEMENTS OF STATISTICS

This is a 30-point course at Level 2, with no residential school.
It requires a personal computer.

The course

The course offers a practical introduction to statistics. It is for those who want to understand and perhaps make use of basic statistical concepts. Although it includes the theoretical principles underlying the practice of statistics, the main emphasis is on a methodological approach.
The course begins with an *Introduction to statistical computing*, which will make you familiar with the skills of using your computer and the statistical package SSC (*Statistical Calculator – Student Version*). The rest of the course is presented as chapters in a textbook *Elements of Statistics*, written by membets of the statistics department. It covers fundamental statistical models for variation (such as the binomial distribution and the normal distribution), and the problem of assessing the quality of the models in a given data context. There are chapters on estimation, confidence intervals, hypothesis testing, regression and two-vatiable ptoblems. There is also an introduction to the statistical analysis of tandom processes. Chaptet 13 acts as a review of the whole course, while Chaptet 14 looks forwatd to more advanced statistical techniques and approaches. The last part of the course consists entirely of extra problems and exercises based on the coutse material, which you might like to use duting the year and as patt of a tevision programme.
The course is based on data and prompted by problems. A typical apptoach might be to present a question such as 'Is this drug better than that?' or 'What is the relationship between this stimulus and that response?' Then data are collected in order to answer the question, and the appropriate statistical methods are developed and discussed. Use of a computer is an essential part of the course, and you will be given detailed guidance for all the computer exercises.

Advice to applicants

Some familiarity with the notions of a mathematical function and of differentiation and integration would be helpful, though it is not essential. You will *not* be expected to follow complicated algebraic arguments in the text or to produce a great deal of algebra in your written work. Similarly, some experience of using a computer would be useful but is not necessary. You are given an introduction to statistical computing, and a brief description of basics of the DOS operating system.

If you are disabled

You will need to be able to use a computer keyboard but it is not necessary to use a mouse. If you need to use a computer with adaptations please consult the Office for Students with Disabilities, The Open University, PO Box 79, Milton Keynes MK7 6AR. We hope that recordings of course materials and audio cassettes will be available. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Two study texts
Elements of Statistics
Study guide
Handbook and statistical tables
Notes to accompany the television programmes

Software
You will receive the necessary statistical software and a *User Guide*, which gives details of the command syntax, file-handling procedures, help facilities and so on. A guide to all the computer exercises in the course text is also provided.

Broadcasts and cassettes
Eight television programmes
One audio cassette

You will also need

Television (preferably colour)
Audio-cassette player
Calculator with basic statistical functions (sample summaries and linear regression)
A computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M246 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed infotmation when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of M246 overlaps with the discontinued course M245, you can count only one of the two towards a BA or BSc.

Professional recognition
This coutse can in some circumstances help you to gain recognition from an employer. It is also tecognized by professional bodies such as the Institute of Hospital Engineering, the Institute of Materials and the Royal Statistical Society, and is included in the Open University degree profile recommended by the police training authorities. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.10 *Membership of professional bodies: administration and management institutions*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

M206

MATHEMATICS IN COMPUTING

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This course introduces certain mathematics relevant to computing and shows how this mathematics is useful in computing. In particular, it will make you familiar with the mathematics necessary for a formal approach to the production of software. It is an introductory course at the formal or theoretical end of the range of computing courses and is primarily designed for students who intend to specialize in computer science. It includes no practical computing. The mathematics is chosen for its relevance to software development; hardware is not considered, and mathematical topics to do with other areas of computing such as numerical analysis or statistics are not discussed.
Nevertheless, the course should also be suitable for students whose main interest is mathematics; the relationship between certain fundamental mathematical topics and certain ideas in computing is of interest to the pure mathematician, and although the mathematics discussed here is quite separate from that in applied mathematics courses, the theme of modelling is common to both.
The course is divided into four blocks of work, each taking eight weeks. Each block is divided into chapters.
We begin with chapters on *Numbers and machines*, *Describing functions* and *Algorithms and pseudocode*. A calculation is seen as the evaluation of a partial function
f:X → Y. To *describe* a function one must state what type of thing it inputs and what type of thing it outputs; what inputs, if any, are excluded (such as negative numbers for SQUARE-ROOT); and how the input and output are related. Such a description does not tell us *how* the function is to be evaluated. An *algorithm* is a method of calculation. A Pascal-like pseudocode is introduced to describe algorithms.
Many of the functions of interest in computing do not have numerical inputs and outputs. A chapter on *Data types* looks at other types of object, such as strings and trees, and shows how examples of these are used to describe real situations. *Sets* can be seen as a type of object in this context. *Manipulating functions* looks at examples of algorithms expressed purely in terms of composition and iteration of certain basic functions. *Logic* looks at expressions that are either true or false, used in 'controlling' pseudocode algorithms. *Binary relations* and *n-ary relations* cover further mathematical structures that are useful to describe real objects. *Recursion* returns to algorithms expressed in terms of functions, looking at a powerful tool for doing this. *Efficiency of algorithms* considers the estimation and comparison of the time taken to execute an algorithm. The course ends with chapters on *Proof* and *Operations*.

Advice to applicants

This course is *not* suitable for the mathematically naive. A-level mathematics or the equivalent should give you all the knowledge you need, but

this course requires a somewhat higher level of sophistication that can come as a surprise. Some knowledge of computing, particularly programming, at a general level would be an advantage but is not necessary.

Preparatory work

You might find it useful to look at the University's introductory mathematics courses: M101 *Mathematics: a foundation course*, MS284 *An introduction to calculus* or TM282 *Modelling with mathematics: an introduction*. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy them from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

This course presents no special difficulties. Printed course materials are available on cassette, and there are transcripts of the course's audio cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Thirteen study texts

Cassettes
Four audio cassettes

You will need

Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M261 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It is also part of the University's Diploma in Computing.

Professional recognition
This course can in some circumstances help you to gain recognition from professional bodies including the British Computer Society. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

For the future

The course may be presented for the last time in 1998. We hope to make it available after that, but the decision has not yet been made.

M828

TOPICS IN THE HISTORY OF MATHEMATICS

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

The main aim of this course is to introduce the study of the history of mathematics. This means both telling the story of the development of mathematics in the past and practising the historical judgements and methods that enable the story to be told. The course should also deepen your understanding of what mathematics is, and the role it has played in society and in increasing our knowledge of the world.
The course is intended for interested people from a variety of backgrounds: students of mathematics who want more understanding of its historical development, teachers of mathematics at all levels, who will find such material enriching to their pupils' learning, and people who have a general interest in social and cultural history.
Our approach is largely based on texts. The set book is a collection of writings by past mathematicians and present-day historians. So we start from what past mathematicians actually said (or the nearest we can get to it, in translation) and see how that relates to the society they were working in and the problems they were trying to solve. As we get nearer to our own time you can see the characteristic features of modern mathematics emerging.
The course is arranged in four sections of two months' study time each.
Mathematics in the ancient world moves from the earliest evidence for mathematical activity, before the time of the Egyptians and Babylonians, through the achievements of classical Greece to Euclid's *Elements* and the great geometers Archimedes and Apollonius. Mathematics has ever since borne the stamp imprinted by the Greek approach.
Through the Middle Ages to the seventeenth century We follow the development of the algebraic approach through Muslim culture and then the rediscovery in Europe of classical Greek texts at the end of the sixteenth century, which helped lead to an unprecedented flowering of mathematics in the next century. We look at the time of Napier (logarithms) in Scotland; Descartes (algebraic geometry) in France; Kepler in Germany and Galileo in Italy applying mathematics to the world; and the invention of the calculus. There is a case study of English mathematics education during this period.
The seventeenth and eighteenth centuries The calculus was invented, independently and in rather different ways, by Newton and Leibniz (building on the work of many earlier mathematicians). What were the consequences of this? We trace some developments through the eighteenth century, and examine how algebraic concerns reached almost their modern form in the work of the great Swiss mathematician Leonhard Euler.
Topics in nineteenth-century mathematics Is Euclid's 'parallel postulate' necessarily true, or can other logically consistent geometries be devised? Can a formula be found for solving equations of the fifth degree or, if not, why not? Was the French Revolution a good thing (for the development of geometry)? Were the foundations of the calculus secure – if not, what to do about it? (Or did it matter?) Can calculation be mechanized, and at what cost? Can you 'prove' a theorem by using a computer? These are some of the questions discussed in this survey of characteristic topics of nineteenth-century mathematics that are the basis for many of the concerns and approaches of mathematics in the twentieth century.

Advice to applicants

Little particular mathematical knowledge is expected of you at the beginning of the course, but a familiarity with the subject will help. The knowledge you need is generally explained through its historical development in the course, and we have tried to make it accessible to students with a modest mathematical background, whose needs have been borne in mind throughout the preparation of the course material. You are expected, though, to be willing to engage with some mathematical explanations as the course progresses.

Preparatory work

If you want to get a preliminary flavour of the kind of thing the course covers, you could browse through a standard work such as *A History of Mathematics* by Carl B. Boyer (Wiley). This book is at a level comparable with that of the course.

If you are disabled

This course presents no special difficulties. Printed course material is available on audio cassette, and there are transcripts of broadcasts and the course cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Seventeen course texts
Eight television programmes
Ten audio cassettes

You will need to buy

Set book
J. Fauvel, J. Gray (eds.) *History of Mathematics: a Reader*, MacMillan Education, £19.50
(1996 price)

You will also need

Television
Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MA290 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflet:
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
You can get this from your Regional Centre.

For the future

MA290 will be presented for the last time in 1998. A new course in the same subject area is planned for 1999.

MA290

STATISTICS IN SOCIETY

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

Statistical information, and ways of dealing with it, plays an increasingly important part in our lives. This course offers an uncomplicated yet critical introduction to current statistical ideas and practice, and demonstrates a variety of applications of statistics in everyday life.
Statistical concepts are introduced to help make sense of practical problems and to help answer such questions as 'Are we getting better off?' and 'Is my child developing normally?'
The course is intended for anyone who is interested in statistics and how they affect everyday life, and should be useful to people who need a basic understanding of statistics for their work or for studies in other disciplines. A course of this length cannot cover the whole range of statistical techniques, but it should give you an intuitive understanding of the principles of using statistics and so help you to assimilate new statistical techniques when you meet them in other contexts.
The course begins with an introduction to some basic ideas about statistics and various ways of presenting numerical information. Then come three sections, each ten weeks' work, consisting of teaching texts followed by a review. Each review summarizes the statistical ideas developed in the section and illustrates how they can be applied to various problems. We look at topics like development aid, home insulation, plant ecology and psychology.
The first section asks 'Are we getting better off?' In this broad *economic* context we develop ways of exploring batches of statistical data. Methods of summarizing data, graphical representation of data and relationships between different quantities are all discussed. We investigate the process of obtaining data to do with pay, prices and other variables from sample surveys, and look briefly at some aspects of official statistics.
The next section looks at *education*. Many important ideas in statistics are concerned with inference – drawing conclusions from data. We develop the basic concepts of statistical inference in the context of questions like 'Does class size affect performance?' and 'How effective is parental help for children's learning?' We discuss the statistical concepts of probability, confidence intervals, hypothesis testing and the normal distribution.
The last section investigates *medicine and health*. Experiments are important in many fields of knowledge, and it is often necessary to use statistical ideas at the planning stage of an experiment so that the information obtained is as useful as it can be. We look at some of these ideas and their application in testing new drugs. You will have an opportunity to carry out a simple experiment and analyse the results from it (you will need no special equipment for this).
Finally, we look at the relevance of statistics to personal and public decision-making by investigating questions about children's development and about the relationship between smoking and lung disease.
Twelve of the texts include a cassette session in which you listen to a twenty-minute commentary and carry out calculations at various points. The course also includes six television programmes that describe applications of statistics in various fields.

Advice to applicants

This course does not depend on any other Open University course, and could be a very suitable introduction to study with the University. The only knowledge you are expected to have when you start is some basic mathematics.

Preparatory work

Before the course begins we shall send you a diagnostic test with which you can judge whether you have the necessary mathematical skills. A book, Volume 1 of *Countdown to Mathematics* by L. Graham and D. Sargent, published by Addison-Wesley, has been specially written to help you to prepare for a course such as this and to overcome any problems that the diagnostic test brings to light.

If you are disabled

There might be difficulties, particularly with the extensive use of graphical presentation and the importance of the audio cassettes and television programmes, but the course will not be impossible. Parts of it are being rewritten, so recordings of printed materials might not be available in 1997, but there are transcripts of the audio-visual materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen course texts
Course guide
Course handbook

Broadcasts and cassettes
Six television programmes
Three audio cassettes

You will need

Television
Audio cassette player
Calculator – the course guide will describe the type you need

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In

MST121 this rule can apply to one tutor marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *F*, which means that it is equally appropriate to either.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by the Royal Statistical Society and is included in the Open University degree profile recommended by the police training authorities. It is also one of the courses approved for the Merchant Navy Extra Master's Certificate. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers. Civil Service, armed forces, merchant navy, police and public corporation*
3.2 *Membership of professional bodies. the Royal Town Planning Institute*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

MS221

USING MATHEMATICAL THINKING

This is a 30-point course at Level 2, with no residential school.
Use of a personal computer is optional.

The course

This course is particularly appropriate for teachers of pupils between the ages of 5 and 16+, or people who are engaged in some other capacity in the education of children of that age. It is suitable for all teachers who are interested in mathematics as well as for mathematics specialists, and should support them in carrying out the national curriculum.

As well as helping pupils to *acquire* mathematical knowledge and skills, a sound mathematics curriculum should encourage the ability to *use* and *apply* knowledge and skills in context. This is emphasized in the national curriculum for mathematics. Such contexts may be mathematical, they may be associated with other areas of the curriculum, or they may be of an everyday nature. In order to be able to apply mathematical ideas, pupils also need to be able to make sense of them, which is often impossible to do in the abstract. This course is about helping pupils to develop their own understanding and to take some responsibility for their own learning.

An important theme running through the course is the progression Adult Process Classroom. Consideration of adult learning and mathematical needs enables us to recognize processes that are important for learning mathematics and ways of working in the classroom that make these processes explicit to pupils. The course invites you to work on some mathematics yourself as a learner, to observe your own learning processes and to relate what you notice in your own learning to your pupils' learning in the classroom. This should develop an awareness of mathematical learning processes that will give you insight into ways of helping pupils to learn.

The course is divided into three. The first section is concerned with the investigation of mathematical ideas in a mathematics context; the next with the investigation of mathematical ideas in a wider context, such as other curriculum areas or everyday situations; and the last links the first two blocks in considering issues of assessment and evaluation and process links with other subject areas.

The first section presents mathematical domains concerned with numerical and spatial ideas, from which you select two to study in the form of investigational work in and around the content of the domain. An investigational approach ensures that the course is suitable for students from a wide variety of mathematical backgrounds. You will also look at processes inherent in mathematical problem solving, and at classroom issues to do with pupils working investigatively in mathematics lessons.

The second section is about tackling problems that are not initially mathematical in nature but for which mathematics may provide a means of finding a solution. You will work on problems of various degrees of complexity, with a strong emphasis on the links between the 'real' problem and the mathematical problem that is constructed from it. Statistical ideas and mathematical modelling strategies form a large part of this study, so you can consider classroom issues associated with pupils working on such problems.

The last section is about the place of mathematics in the curriculum and invites you to follow up ideas from the earlier sections and their applicability across the curriculum. This will involve consideration of explicitly mathematical concepts and processes that are applicable in other subject areas. Important, too, are the processes and content of other subject areas that are applicable to the learning of mathematics.

Attention is also paid to assessment and evaluation, requiring you to examine your own criteria for evaluating your pupils' work and making assessments. In doing this, various styles of evaluation procedures will be considered and applied in the classroom.

Advice to applicants

You are not expected to have mathematics beyond O-level, but you must have an interest in mathematical ideas and their application. In order to participate in the study and assessment activities you will need to be able to work with a group of children, preferably in a classroom.

If you are disabled

Video cassettes are an important part of the course. If you would not be able to make full use of them, please ask for advice from your Regional Centre. Transcripts of the audio cassettes are available, but there are no recordings of the printed course materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Thirteen course texts
Video and audio notes

Cassettes
Two video cassettes
Three audio cassettes

You will need to buy

Set book
D. Pimm (ed.) *Mathematics, Teachers and Children*, Hodder and Stoughton, £14.25 (1996 price)

You will also need

Video cassette recorder and player (VHS)
Audio cassette player
Opportunity to work with a group of children, preferably in a classroom

Computer or graphics calculator

You will be encouraged to think about the contribution that aids such as computers or graphics calculators can offer to mathematical thinking, so you will need either or both in order to take the course. The computer must be capable of running a version of the software package Logo, and you should have access to a spreadsheet package. More information is given in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In ME234 this rule can apply to any one assignment except the one that describes and analyses a classroom project. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

It is also part of the University's Advanced Diploma in Education programme. If you would like to know more about this please ask your Regional Centre for the *Professional Development in Education* brochure.

Professional recognition

This course can in some circumstances help you towards a professional qualification. You can find out more in our Recognition Information leaflet:

3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*

You can get this from your Regional Centre.

For the future

ME234 may be available for the last time in 1999.

MS221

EXPLORING MATHEMATICS

This is a 30-point course at Level 2, with no residential school.
It requires a personal computer.

The course

Exploring mathematics offers both a way in to honours-level mathematics and deeper insights into the mathematics that support other areas of study. It rounds off the suite of courses designed to provide a rich and critical introduction to mathematical thinking. Even if you intend to take mathematics no further you will gain from it a good understanding, appropriate to a general university-level education, of the nature and scope of mathematics.

This course builds on MST121 *Using mathematics* in mathematical concepts and techniques, in their application, and in the use of the personal computer. It adds an emphasis on some specifically mathematical topics, looking at questions underlying some of the methods from MST121, such as why particular patterns occur in mathematical solutions, and how you can be confident that a result is true. It introduces the role of reasoning in mathematics, and offers opportunities to investigate mathematical questions for yourself. By the end of the course you will have encountered many of the topics that are developed in later mathematics courses.

The course is in four blocks, each divided into four chapters Block A *Exploring representations* revisits and develops many of the ideas introduced in the corresponding block in MST121. The first chapter, *Exploring numbers and formulas*, works on terms of the Fibonacci sequence and on the Golden Ratio. *Exploring conics* demonstrates different ways of representing the family of conic sections, and draws attention to some occurrences of conics in the physical world. *Exploring transformations* introduces the mathematical transformations of translation, reflection and rotation. The last chapter, *Functions from geometry*, uses many of the geometrical ideas from the previous two chapters to form functions that model situations such as navigation, shadows and the trajectory of a tennis ball.

The second block, *Exploring discrete mathematics*, starts with a chapter called *Further functions* that moves from the study of particular functions to look at properties of functions such as being increasing (or decreasing), onto and one-to-one. The processes of inverting and composing functions are also explored. *Algorithms and recursion* discusses the kinds of mathematical object known as data types and the kinds of algorithm that can be handled by computers. In particular, the binomial expansion of $(a+b)^n$ is derived and used. The remaining two chapters introduce the idea of *Iteration*. The first examines the behaviour of sequences of number generated by iterating functions. The second deals with *Iteration and matrices*, and applies this to population problems. Also, in this chapter, the matrix representations of geometric transformations are explored.

The theme of Block C is *Exploring continuous mathematics*. In the first two chapters the processes of *Differentiation* and *Integration* are revisited in greater depth than in MST121. Further techniques such as the product and chain rules for differentiation, and integration by parts and by substitution, are derived and used. The later chapters introduce *Taylor polynomials* and do further work on *Differential equations*.

The last block, *Structure in mathematics*, introduces important mathematical ideas that are built on in later courses. In particular there are chapters on *Complex numbers*, *Modular arithmetic* and *Groups*. The block and the course culminate in a chapter that collects and consolidates the ideas of *Proof and reasoning* which have emerged in earlier chapters, and introduces new techniques such as proof by induction.

Advice to applicants

This course is part of an 'entry suite' that also includes MU120 *Open mathematics* and MST121 *Using mathematics*. You can take one, two or all three courses from this group: your choice will depend on how much mathematical knowledge you already have and on the degree you have in mind. We recommend taking this course either alongside or after MST121. If you have any doubt about your ability to take MS221, or about choosing the most suitable mathematics entry course, please seek advice from your Regional Centre and ask for the leaflet *Mathematical Choices*.

If you are disabled

We are trying to make the course materials accessible to everyone. Course material will be recorded on audio cassette after 1997, the course's first year, and we intend to make transcripts of television, video and audio cassettes available. Work with a personal computer is an essential part of the course, so if that might cause difficulties for you please consult the Adviser for Students with Disabilities at your Regional Centre. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts (grouped into four blocks)
Four computer books
Course guide
Course handbook
Learning file
Resource book
Notes to accompany the broadcasts

Broadcasts and cassettes
Sixteen television programmes (these are for the whole suite of mathematics entry courses)
Video cassettes
Audio cassettes

Software
All the software you will need will be supplied

You will need

Television
Video cassette player (VHS)
Audio cassette player
A scientific or graphics calculator (the calculator used in MU120 will be suitable)

You will need a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre). If you want to take part in the optional computer conferencing you will also need a modem.

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a

'substitution score', calculated as a weighted average of all your scores for the course. In MS221 this rule can apply to one assignment. You will be given more detailed information when you begin the course

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of MS221 overlaps with MS284, and with the discontinued courses M101, M100, MS283, TM282 and TM281, you can count only one of these courses towards a BA or BSc.

Vocational qualifications
This course can contribute to the award of a National or Scottish Vocational Qualification; it develops general skills in communication, problem-solving, application of number, information technology and developing one's own learning, as defined by General National Vocational Qualifications Level 4. We will send you more information if you register for the course.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body, and can be accepted as an entry qualification in mathematics for admission to a postgraduate certificate in education. You can find out more in our Recognition Information leaflets:

1.1 *Particular careers: teaching: training and salaries (England, Wales and Northern Ireland)*
1.2 *Particular careers: teaching: training and salaries (Scotland)*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*

You can get these from your Regional Centre.

MS284

AN INTRODUCTION TO CALCULUS

This is a 30-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course offers an introduction to mathematics, especially the calculus, for people whose main interests lie in the areas of physics and technology. At the same time it gives a sound foundation for further study in mathematics.
The first eight weeks of the course are designed to bring all students to a common level of competence in basic algebra and trigonometry, and they also introduce some fundamental concepts that will eventually lead to the calculus. The topics covered include numerical solutions of equations; the binomial theorem; the laws of indices and logarithms; the trigonometric ratios (sin, cos and tan); the concept of a function; composition of functions; complex numbers; some simple statistical concepts such as mean and standard deviation; and the graphical analysis of experimental data.
The core of the course is an introduction to the calculus of functions of a single variable. The topics covered here include the differentiation of polynomial functions, trigonometric functions and exponential and logarithmic functions; application of differentiation to maxima and minima problems; Taylor series; the integration of simple functions introduced as the area under a graph; the fundamental theorem of calculus; the techniques of integration by parts and by substitution.
The course ends with some applications of the calculus and vectors in mathematical modelling. Science programmes on video cassette are an essential part of the course. Although they are summarized in the printed texts, you will be at a disadvantage if you cannot watch them. You may need to use the video material in the work you do for your tutor.

Advice to applicants

You are expected to have basic mathematical skills – very roughly, those covered in the first four years of secondary school mathematics. If you register for the course you will receive a diagnostic test that will tell you exactly what is required and enable you to judge whether you are adequately prepared. Two books have been specially written by members of the Mathematics Faculty to help students prepare for this course and overcome any difficulties that the diagnostic test brings to light: they are Volumes 1 and 2 of *Countdown to Mathematics* by L. Graham and D. Sargent, published by Addison-Wesley. Volume 2 is provided with the diagnostic test. These books will also get you into the way of studying in your own home.

If you are disabled

There are likely to be some difficulties, but they are probably not impossible to overcome. You need to be able to use a calculator. Printed course materials are available on audio cassette and there are transcripts of the audio and video cassettes, which are an essential part of the course. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seventeen course texts
Exercise booklets

Cassettes
Four audio cassettes
Sixteen programmes on video cassette

You will need

Video cassette player (VHS)
Audio cassette player
Calculator – the preparatory booklet will describe the type you need

Residential school

The one-week summer school will give you a chance to do mathematics with other people. You will meet fellow-students, revise and review the work you have done in the course, attend lectures on mathematical and scientific topics and work in small groups with tutors on activities such as problem-solving. The school should help you to put your work in perspective and encourage you to tackle things that may have daunted you. There are opportunities to do some computing with the mathematics you have learnt and to interpret mathematically the results of some simple experiments.
The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, six computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MS284 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of MS284 overlaps with MST121 and MS221, and with the discontinued courses M100, M101, MS283, MST281, TM281 and TM282, you can count only one of these courses towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body.
You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.7 *Membership of professional bodies: Institute of Acoustics*

You can get these from your Regional Centre.

For the future

MS284 may be available for the last time in 1999.

MST206

MATHEMATICAL MODELS AND METHODS

This is a 60-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course will be of particular interest to you if you use mathematics or mathematical reasoning in your work and feel that you need a firmer grounding in it, or if you think you might find it useful to extend your application of mathematics to a wider range of problems. The course should also be suitable if you are teaching A-level applied mathematics, or if you intend to do so; the material on mechanics, in particular, gives a very careful treatment of the basic concepts of this subject.
The course teaches the use of mathematics in solving real problems. Half of it is about representing suitable aspects of the real world by means of some mathematical model; the other half is about mathematical methods that are useful in working with such models. The work on models is subdivided into nine weeks' study of mechanics, three weeks on non-mechanical models and four weeks devoted to giving you experience of doing your own modelling. The work on methods comprises topics chosen for their usefulness in dealing with the models; the main emphasis is on solving the problems generated by the modelling rather than on axiom systems or rigorous proofs. There are four weeks' work on numerical methods, four on differential equations, four on aspects of algebra and four on advanced calculus.
The mechanics part of the course begins with the fundamental laws governing the motions of bodies acted on by forces – Newton's laws of motion. These are first applied in the simplest case, a single body moving in a straight line under the influence of a known force. Oscillations, free and forced, damped and undamped, are discussed next; the theory is then extended to the motion of a body in space and of assemblages of bodies. Finally the motion of the planets around the sun is analysed.
The non-mechanical modelling is concerned with population growth and heat transfer, together with a text on the general skills used in modelling.
For your work on mathematical modelling you are given a problem of non-mathematical origin; your tasks are to use mathematical modelling to help solve the problem, to test your conclusions against real data, improving the model where necessary as a result, and to write a report. You will have a correspondence text to help you with this work, which will begin at the residential school in collaboration with other students and with the support of a tutor.
The study of numerical techniques covers recurrence relations, the solution of systems of linear algebraic equations, methods for approximating polynomial functions and the numerical solution of differential equations. The analytical (as opposed to numerical) solution of first-order and linear, constant-coefficient second-order ordinary differential equations is discussed, followed by systems of simultaneous differential equations and an introduction to partial differential equations.
The topics in algebra are complex numbers and functions, vector algebra and aspects of the theory of matrices and determinants. Finally we develop the elements of the calculus of functions of several variables, including vector calculus and multiple integrals, and make a start on the study of Fourier analysis.

Advice to applicants

You need no knowledge of mechanics, but the course is not recommended if you have little mathematical experience. You will need a good basic working knowledge of algebra, geometry, trigonometry and calculus. In algebra you must be able to solve linear and quadratic equations with one unknown, to multiply and add polynomials and to factorize quadratic polynomials. In geometry you must know Pythagoras' theorem and how to use Cartesian co-ordinates, e.g. the equations of straight lines and circles. In trigonometry you must know the definition and basic properties of the three trigonometric ratios sine, cosine and tangent, and the definitions of the corresponding inverse functions. In calculus you must be able to differentiate and integrate, though great facility in integration is not necessary.
This course was written to follow M101 *Mathematics: a foundation course* or MS284 *An introduction to calculus* or TM282 *Modelling with mathematics: an introduction*. You are advised first to obtain a good pass in one of these (or to make sure that your knowledge is at an equivalent standard). Your Regional Centre will be able to tell you where you can see reference copies of the courses to get an idea of what is required, or you can buy selected texts from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you register for the course you will receive a preparatory text that will enable you to revise the necessary topics before the course begins, but it is not suitable for learning them for the first time. If you are new to any of these topics, MS284 *Introduction to calculus* or TM282 *Modelling with mathematics: an introduction* is probably a more suitable course for you.

If you are disabled

Printed course materials are available on audio cassette, and there are transcripts of the television programmes and the course's audio cassettes. The residential school is an important part of the course. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Twenty-nine course texts

Broadcasts and cassettes
Thirty-three television programmes
Six audio cassettes

You will need

Television (preferably colour)
Audio cassette player
Pocket calculator with the basic mathematical functions such as e^x, $\log_e x$, $\sin x$, $\arcsin x$ and so on, and a memory

Residential school

A one-week residential summer school, the fee (£199 in 1996) is not included in the course fee. The school includes activities such as lectures, tutorials and exercise classes on the mathematical methods and standard models taught in the course; one or two mechanics experiments and associated modelling; a chance to work with computers on numerical methods. Work carried out at the residential school contributes to two of the tutor-marked assignments. The report on the modelling exercise constitutes one of them, and another assignment is based in part on the numerical analysis carried out in the computing sessions.

Assessment

There are eight tutor-marked assignments, eight computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a

'substitution score', calculated as a weighted average of all your scores for the course. In M571 this rule can apply to two tutor-marked assignments and two computer-marked assignments. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition

This course can in certain circumstances count towards membership of professional bodies such as the Institute of Mathematics and its Applications, the Institute of Physics, and many professional engineering institutions including the Institute of Mechanical Engineering. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Water Management*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.7 *Membership of professional bodies: the Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

For the future

MST204 will be available until 1998. It will be replaced in 1999 by a new course covering similar topics, but the new course will make much more extensive use of computing and will require a personal computer.

M334

GROUPS AND GEOMETRY

This is a 30-point course at Level 3, with no residential school.
Use of a personal computer is optional.

The course

The main theme of the course is the construction, recognition and classification of certain types of structure. The geometric structures studied include tiling, frieze and wallpaper patterns, and three-dimensional objects such as regular solids and crystals are also introduced. The algebraic structures, on the other hand, are groups – symmetry groups of geometric structures, and more abstractly defined groups characterized in terms of algebraic relationships between generating elements.

After an introductory section, the texts divide into a Geometry stream and a Groups stream. In the Groups stream you will learn how to construct the *cyclic groups* (groups generated by a single element) and the *finite abelian groups* (commutative groups containing finitely many elements), and you will also learn how to use a *classification algorithm* for the latter so that, given information about the relationships between generating elements, you can completely characterize the group. The stream ends with an introduction to the problem of classifying groups that are not given to be abelian.

In the Geometry stream you will see how to classify the seven types of *frieze pattern* and the seventeen types of *wallpaper pattern*, and you will receive software with which you can generate your own wallpaper patterns. (This software is an optional extra for those who have access to a suitable PC-compatible computer, and you will not be at a disadvantage if you are not in a position to use it.) You will also learn how to classify certain types of repeating *tiling* of the plane. The stream ends with an introduction to the study of similar structures in three dimensions.

Advice to applicants

Although the course is self contained and all the essential material is revised in the introductory section, you are likely to find it hard going if you are not at all familiar with group-theoretic and geometric thinking. You could get the necessary background from the Level 2 mathematics course M203 *Introduction to pure mathematics*. The introductory block of M336 revises the essential material from M203 but on the assumption that you have seen it before. Your Regional Centre will be able to tell you where you can see reference copies of M203, or you can buy selected texts from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

The visual nature of the geometry part of the course is evident in the many diagrams, in the tiling and frieze cards and overlays, and in the video cassettes. We are trying to find ways to help with the difficulties this may present, but there are no recordings of printed course materials. We can provide transcripts of the audio and video cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen course texts
Course guide
Two exercise booklets
Video notes
An envelope of cards and transparent overlays for the Geometry stream

Cassettes
Four video cassettes
Three audio cassettes

Software
PC-compatible software for optional use

You will need

Audio visual equipment
Video cassette player (VHS)
Audio cassette player

Computer (optional)
If you want to run the optional software you will need an IBM-compatible computer running MS-DOS version 5.0 (or higher) and Windows 3.1 (or higher), with 4 Mbytes RAM and a 386 processor. It must have a high-density disk drive and a 40-Mbyte hard disk, VGA graphics and a compatible colour monitor). There is more information in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M336 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body. It is recognized by the Institute of Hospital Engineering and the Institute of Mathematics and its Applications. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*

You can get these from your Regional Centre.

M337

COMPLEX ANALYSIS

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

There is no real number whose square is −1, but mathematicians long ago invented a system of numbers, called complex numbers, in which the square root of −1 does exist. These complex numbers can be thought of as points in a plane, in which the arithmetic of complex numbers can be pictured. When the ideas of calculus are applied to functions of a complex variable a powerful and elegant theory emerges, known as complex analysis.

The course shows how complex analysis can be used:

- To determine the sums of many infinite series, such as
$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots = \frac{\pi^2}{6};$$
- To evaluate many improper integrals, such as
$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi};$$
- To find the zeros of polynomial functions.
- To give information about the distribution of large prime numbers.
- To model fluid flow past an aerofoil.
- To generate certain fractal sets whose classification leads to the Mandelbrot set:

The fourteen study texts make up four blocks of work, roughly equal in length:

Introduction Complex numbers, complex functions, continuity, differentiation.
Representation formulas Integration, Cauchy's theorem, Taylor series, Laurent series.
Calculus of residue Residues, zeros and extrema, analytic continuation.
Applications Conformal mappings, fluid flows, the Mandelbrot set.

The texts have many worked examples, problems and exercises (all with full solutions), and there is a course handbook that includes reference material, the main results and an index. These texts are supported by four audio cassettes that teach complex analysis techniques, while another audio cassette presents a discussion of the central role of complex analysis in mathematics. A video cassette uses computer graphics to demonstrate many geometric properties of complex functions.

Advice to applicants

You will need proficiency in algebra, trigonometry and calculus; you should have experienced at least one year of degree level study in mathematics. For example, a good pass in either M203 *Introduction to pure mathematics* or MST204 *Mathematical models and methods* would be a suitable background for studying M337. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory material

There is no formal preparatory work, but to find out about the course content you might like to consult *Complex Variables* by M. R. Spiegel (McGraw-Hill). This covers similar material to the course, contains many worked examples and exercises, and is widely available.

If you are disabled

The course should present no special difficulties, but it does include a lot of diagrams. Printed course material is available on audio cassette and [illegible] transcripts of the course cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Fourteen study texts
Course handbook

Cassettes
Five audio cassettes
One video cassette

You will need

Audio cassette player
Video cassette player (VHS)
A scientific calculator would be useful but is not essential.

Assessment

There are four tutor-marked assignments and an examination. The University urges you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M337 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses

Because the subject matter of M337 overlaps with the discontinued course M342, you can count only one of the two towards a BA or BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Analysts and Programmers, the Institute of Hospital Engineering or the Institute of Marine Engineers. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

M343

APPLICATIONS OF PROBABILITY

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

This course on probability and its applications emphasizes probability modelling and developing the properties of the models. A considerable amount of mathematics is sometimes required for this development but we do not always give formal proofs, particularly if the proof does not illuminate the probabilistic ideas. The course falls naturally into four sections. The first three texts are introductory. The first develops and develops ideas about probability and introduces some techniques that will be used frequently in the course. The next develops models for events occurring at times, including the Poisson process and several extensions of the Poisson process. The third looks at patterns in space and develops models for random scatter and clustering of objects.

The next section develops models for processes in which events can occur only at discrete time points, for example a Bernoulli process. This includes practical situations such as the ruin of a gambler, the extinction of a family surname and the water-level of a reservoir.

In the next five texts probability models are developed for situations at which events can occur at any time. Examples include queues, the

spread of epidemics, and change in the size of a population due to births and deaths.
In the last section models are developed for various situations including genetics, the renewal of components, the change in stock market prices and the movement of particles in a fluid.
The last text consists entirely of problems and exercises; these are designed for practice, revision and to extend the concepts introduced earlier.

Advice to applicants

You are expected to have a basic knowledge of probability: probability functions for discrete random variables and probability density functions for continuous random variables; the binomial, Poisson, geometric, exponential and normal distributions; the Poisson process.
You are also expected to have a reasonable degree of mathematical competence. Although any special techniques you need are taught in the course, it would be helpful if you have at least met differential equations and matrices.
You could get the necessary knowledge from M246 *Elements of statistics* and one other Level 2 mathematical course: MST204 *Mathematical models and methods* is the most relevant. We have tried to make allowance for the likelihood that not all our students will have taken those courses, and a revision of fundamental notions of probability and probability models is included in the first M343 text. Close study of this, as early as you can, would be good preparation for the rest of the course.
You can get an idea of the level of mathematical competence required by looking at texts from MST204 *Mathematical models and methods*, which gives a useful introduction to techniques. Your Regional Centre will be able to tell you where you can see reference copies of these, or you can buy them from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

Almost all the texts contain detailed diagrams and data tables, and many include audio sessions. There are transcripts of the audio-visual material, but no recordings of printed course materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Fifteen course texts

Cassettes
Two audio cassettes
One video cassette

You will need to buy

H. R. Neave *Elementary Statistics Tables*, Routledge, £8.99 (1996 price)

You will also need

Calculator with the usual mathematical functions (exp, log, sin, cos). It need not have statistical functions.
Audio cassette player
Video cassette player (VHS) desirable but not essential

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M343 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *F*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Royal Statistical Society. You can find out more in our Recognition Information leaflets:
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

M343

PROGRAMMING AND PROGRAMMING LANGUAGES

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

The principal aim of this course is to broaden your understanding of the nature of programming and of what high-level programming languages can do. The course should be of interest to programmers, analysts or teachers of computing, and to anyone who wants an introduction to software engineering. It is not a systematic study of particular programming languages or program construction. The topics covered in the course are:
Revision of key concepts in Pascal
Specifying and implementing data types
Object-oriented programming
Concurrent programming
Prolog
Specifying programming languages
Compiling
Before a program can be written down there are several stages of preparation. One of the most important is specification – defining the details of what the software should do. It turns out that a good way of specifying a piece of software is to state the operations in the context of abstract data types. These operations can be precisely defined through their syntax and semantics. The first part of the course explains how to specify abstract data by means of the syntax and semantics and shows how such specifications for data types can be implemented in a computer program. It becomes clear that the facilities for doing this in Pascal are limited compared with those of a modern object-oriented language.
Each high-level programming language offers a different view of what programming is about: it provides a different model of computing. This is the idea behind the next part of the course, in which you will study a different kind of programming language, Prolog, comparing it with Pascal, and concurrent programming, comparing it with sequential programming.
Programming languages are themselves defined by syntax and semantics and this is the theme behind the last part of the course. A programming language has eventually to be made available on a computer by means of a compiler, and you will use your knowledge of syntax and semantics to write a small compiler.
Two audio cassettes present recordings to accompany the text. Some of the material on the cassettes is not covered elsewhere in the course.

Advice to applicants

You should come to the course with a knowledge of computing equivalent to a first course at a university. You will need a good working knowledge of Pascal, though you might get by with a detailed knowledge of another block-structured language. The Open University course M205 *Fundamentals of computing* would be an ideal preparation. If you want to take M261 *Mathematics in computing* you should do so before M343 since it gives an introduction to some topics studied in M343. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you have not studied computing for some time you should refresh your memory of Pascal.
The following books give some indication of the nature of the topics covered in the course. They are *not* set books and we do not cover their entire contents in this course.
Data structures, abstract data types and Pascal: Kalfman (1992) *Pascal*, Addison-Wesley; Stubbs and Webre (1989) *Data Structures with Abstract Data Types and Pascal*, Brooks-Cole; Thomas, Robinson, Emms (1988) *Abstract Data Types and Ada*, Prentice Hall.
Object-oriented analysis, design and programming: Budd (1991) *An Introduction to Object Oriented Programming*, Addison Wesley; Meyer (1988) *Object Oriented Software Construction*, Prentice Hall; Rumbaugh *et al.* (1991) *Object Oriented Modelling and Design*, Prentice Hall.
Concurrent programming: Bustard, Elder, Welsh (1988) *Concurrent Program Structures*, Prentice Hall.
Prolog: Leadbetter, Thomas, Weedon (1991) *Prolog – From Formal Specification to Prototype*, Alfred Waller.
Language definition and compilers: Aho, Sethi, Ullman (1985) *Compilers – Principles, Techniques and Tools*, Addison Wesley; Hanson (1985) *Brinch Hanson on Pascal Compilers*, Prentice Hall.

If you are disabled

This course should present no special problems as long as you can use a personal computer. Printed course materials are available on audio cassette, but there are no transcripts of the course cassettes. Please ask your Regional Centre for our booklet *Meeting your Needs* if you haven't already got it.

Course materials

Printed material
Fifteen course texts
Course guide
Personal computing booklet
Notes to accompany the audio cassettes
Index

Cassettes
Two audio cassettes

Software
Five floppy disks

You will need

Audio cassette player
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M353 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc. It is also part of the University's Diploma in Computing.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It is one of the group of courses approved by the British Computer Society and by certain professional engineering institutions. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

For the future

M353 will be presented for the last time in 1998. It is unlikely that it will be replaced by another course in the same subject area.

M353

TOPICS IN SOFTWARE ENGINEERING

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

This course is for people who have a knowledge of programming and want to extend it into activities such as specification, design and software project management. By the end of the course you will be able to use formal methods of software development and have a good understanding of the main problems that occur in complex systems.
Software systems have now become so complicated that they are often delivered late, over-budget and not fully matched to the customer's requirements. In an attempt to overcome the difficulties that result from complexity, developers are trying to apply sound engineering principles to the construction of software systems. This approach is developed in the course, which is split into four blocks of work.
Block I begins by examining the problems that occur in developing large computer systems. It describes what software engineering is and how mathematics can be used in the process of developing large systems. It presents a non-mathematical technique for software development, based on graphical notations, and also describes a mathematical technique that relies on specifying the properties of a software system using predicate calculus.
Block II describes an industrial software development method, known as VDM, that is based on mathematics: the engineer makes mathematical definitions of application data and operations on it. This method was originally developed at IBM and further enhanced in this country. The block is based on a set book, *Introduction to VDM* by M. Woodman and B. Heal (Addison-Wesley: 1994).
Block III describes a software development method suitable for concurrent systems – systems in which many activities are being executed at the same time. These are the most difficult systems to develop, and occur in areas such as avionics and process control. The methods described here use mathematics and a specification and design notation known as CSP, together with the programming language Occam.
Block IV is about project management and software quality assurance. Management is an important part of a successful software project, and the block shows how a project can be planned, monitored and controlled.

Advice to applicants

One of the characteristics of the engineering process is the use of mathematical methods for specification. You will therefore need knowledge of discrete mathematics as well as some experience of programming. The course assumes that you have successfully completed M261 *Mathematics in computing* (or M203 *Introduction to pure mathematics* if you have a computing background) and M205 *Fundamentals of computing* (or a discontinued course in the same area, such as M252). We also strongly recommend taking M353 *Programming and programming languages* before tackling M355.
Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes, MK11 1BY. If you prefer to learn discrete mathematics from a book, we recommend *Discrete Mathematical Structures in Computer Science* by B. Kolman and R. C. Busby

Prentice Hall) or *Introduction to Discrete Mathematics for Software Engineering* by T. Denvir (Macmillan).

If you are disabled

This course presents no special difficulties, except perhaps the large amount of mathematical notation in Blocks II and III. There are recordings of printed course material and are transcripts of the audio cassettes. If you cannot benefit from the sections based on the audio cassettes, you will still be able to follow the course. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Eleven texts and a study guide
Set book
Course guide
Language handbook
Exercise book

Cassettes
Four audio cassettes

You will need

Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M355 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc. It is also part of the University's Diploma in Computing.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Analysts and Programmers or the British Computer Society. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.7 *Membership of professional bodies: the Institute of Acoustics*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

For the future

The course may be available for the last time in its present form in 1997. After that it will be revised.

M357

DATA MODELS AND DATABASES

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This course is about the collections of data stored in databases used by organizations such as hospitals or shops. It examines how each organization has its own particular data requirements, which can be analysed and described by means of a data model. The study of the technology of databases is based on the type of general-purpose software, known as a database management system, that is used to organize and control the data in a database.
The course is for anyone who is concerned with or interested in the planning, design, operation or use of a database. It offers a detailed presentation of the many aspects of database technology, explains the common concepts that underlie it, and analyses the properties of information and its representation in data models.
The course is arranged in four blocks of work.
The first block introduces the context of information systems and the role of databases, defining in general terms the requirements of database management.
The second block is about data models. It examines the role of conceptual data models expressed in terms of entities, attributes and relationships, and the techniques of data analysis for creating them. The rest of the block is a study of data models associated with database schemas: it considers network (Codasyl) and, particularly, relational models.
The third block examines the basic functions of database management systems and the need for design and specification of schemas to control databases. We begin by looking at the topic in general terms applicable to a variety of different types of database management system. The rest of the block explains the use of the standardized database language SQL, and there are practical activities based on a database management system provided for your computer. Among the activities you will be expected to create your own database.
The last block examines wider questions of database management: the general need for integrity of data, the role of data administration and the use of data dictionaries. Examples of the evolving aspects of database technology, such as distributed databases, are presented to show you some of the directions development is taking.

Advice to applicants

You must be familiar with the use of computers, particularly the construction of programs, using files and operating systems. You could get the necessary knowledge from M205 *Fundamentals of computing*; your Regional Centre will be able to tell you where you can see reference copies, or you can buy it from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

The course may present you with difficulties because a computer and audio cassette have to be used simultaneously. Printed course materials are available on audio cassette and there are transcripts of the audio-visual material. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Eight course texts
Software guide

Broadcasts and cassettes
Eight television programmes
Audio cassettes, used as part of the practical activities with the computer

Software
Database software is provided to give you practical experience of many of the concepts covered by the course.

You will need

Television
Audio cassette player
A computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M357 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.
It is also part of the University's Diploma in Computing.

Related courses
Because the subject-matter of M357 overlaps with the discontinued course M352, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you towards a professional qualification. It is recognized by professional bodies including the British Computer Society and the Institution of Analysts and Programmers. If you are working towards an Engineering Council qualification, it is included in the degree profiles recommended by the Royal Aeronautical Society, the Institution of Electrical Engineers, the Institute of Hospital Engineering and the Institution of Nuclear Engineers. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

For the future

M357 will be presented for the last time in 1997; it will be replaced (by M358) in 1998.

M372

NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This course outlines the numerical methods that are used to solve both ordinary and partial differential equations. It will enable you to choose a suitable method and to understand the conditions required for the method to work, and it provides computer software that can be used to obtain numerical results and estimate their accuracy.
Numerical analysis is a practical subject supported by a great deal of mathematical theory. Differential equations arise in mathematics, science, technology, engineering and economics as well as in many other fields. Finding a solution usually takes the following four main stages:

- Formulation of the problem in mathematical terms ('modelling').
- Devising a method of obtaining a numerical solution from the mathematical model.
- Making observations of the numerical quantities relevant to the solution of the problem.
- Calculating the solution, usually with a computer or at least a scientific calculator.

Differential equations arise in many different contexts. Some examples are: population modelling, making assumptions about birth rates, death rates, immigration, emigration, food supplies, predators and so on; in engineering, modelling the deflection of a beam supported at both ends, making assumptions about the elasticity of the material, the cross-sectional area of the beam, other applied loads and so on; modelling heat conduction along a bar heated at one end; modelling the slow motion of an incompressible fluid. Each model consists of a differential equation subject to initial or boundary conditions. The problem can then be analysed and a suitable method chosen, and a computer can use the method to produce solutions consisting of numerical values and graphs.
The first of these stages, mathematical modelling, is part of this course (and is also the subject of other Open University courses), but it concentrates on the second stage, devising a method, and also on the fourth stage, calculating numerical solutions. Nevertheless it is important to bear in mind the full process of four stages, and to understand that what usually matters is the numerical accuracy of the whole problem and its solution.
The course is divided into four blocks of work, each taking eight weeks, and about a quarter of the study time is devoted to practical work on a personal computer. Throughout the course the theory is prompted by examples and case studies.
Block I Methods of interpolation; methods of solving systems of linear equations; numerical integration methods. Errors in numerical processes, convergence, ill-conditioning, induced instability and sensitivity analysis.
Block II Numerical methods for initial value problems in ordinary differential equations, including linear multistep and Runge–Kutta methods. Consistency, stability and convergence.
Block III Finite difference methods for solving boundary value problems in ordinary and partial differential equations.
Block IV Finite element methods for solving boundary value problems in ordinary and partial differential equations.

Advice to applicants

You are expected to bring to the course some knowledge of:
Calculus Ways of differentiating and integrating a variety of functions analytically; Taylor's theorem with remainder; methods of solving simple differential equations analytically; partial derivatives.
Linear algebra Matrices and vectors; Gaussian elimination for solving systems of linear equations; eigenvalues and eigenvectors; linear dependence.
If you haven't got the necessary skills in calculus and number theory you are advised to study MST204 *Mathematical models and methods* first.
Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you would like to do some preparatory reading you could choose from:
R. L. Burden, J. D. Faires (1985) *Numerical Analysis*, 2nd edition, Boston: Duxbury Publishing Company, chapters 1, 3, 4, 5, 6, 8, 10, 11.
K. E. Atkinson (1989) *An Introduction to Numerical Analysis*, 2nd edition, John Wiley and Sons, chapters 1, 3, 5, 6, 7, 8.
The following material from other Open University courses would be useful:
MST204 *Mathematical models and methods*: Unit 1 Recurrence Relations; Unit 2 Differential Equations I; Unit 6 Differential Equations II; Unit 9 Simultaneous Linear Algebraic Equations; Unit 18 Polynomial Approximations; Unit 19 Numerical Methods for Differential Equations; Unit 20 Matrix Algebra and Determinants; Unit 21 Eigenvalues and Eigenvectors; Unit 22 Simultaneous Differential Equations; Unit 25 Functions of More Than One Variable; Unit 26 Vector Calculus; Unit 27 Multiple Integrals; Unit 32 Partial Differential Equations.
M371 *Computational mathematics*: Unit 1 Introduction to Numerical Methods; Unit 2 Systems of Linear Equations; Unit 3 Iterative Methods for Systems of Equations.
Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

You will need to use a computer and a mouse, and you may have difficulties with the practical work if you have a visual disability. There are transcripts of the course cassettes, but there are no recordings of the printed material. Please ask

your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Thirteen study texts
Course guide
Handbook
Two computing booklets

Cassettes
Audio cassettes, used in conjunction with the teaching packages on the computer.
Software: teaching and application packages will be supplied on disk. Computer programming is not part of the course.

You will need

Audio cassette player
Scientific calculator
Computer as described in the leaflet *Personal Computer for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments and an examination. Each assignment has a practical computing element for which you are expected to use the computing packages provided. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M372 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.7 *Membership of professional bodies: Institute of Acoustics*
You can get these from your Regional Centre.

For the future

This course is available in odd-numbered years only, and may be presented for the last time in 1999.

M381

STUDIES IN PURE MATHEMATICS: NUMBER THEORY AND MATHEMATICAL LOGIC

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

The course will give you an insight into two branches of very pure mathematics that have both historical and philosophical significance. By the end of it you should feel confident to tackle number theoretic problems and have an appreciation of the nature and limitations of mathematics.
The course consists of two independent sections that are studied concurrently. Each has its own course texts and written work, and one has a set book.

Number theory
This section is concerned with the integers, and in particular with the solution of classical problems that require integer solutions. It begins by considering some elementary properties of the integers such as divisibility and greatest common divisors. This leads to a method of solving the linear Diophantine equation $ax + by = c$, that is finding solutions to the equation that are integers.
Every integer greater than 1 is shown to be a unique product of primes, and some results are obtained concerning the distribution of primes among the integers. In the theory of congruences, methods are developed for solving linear congruences such as $ax \equiv b \pmod{n}$ and the classical theorems of Fermat and Wilson are obtained. We then consider multiplicative functions: functions f satisfying $f(m)\,f(n) = f(mn)$ for relatively prime integers m and n, and in particular Euler's ϕ-function, which counts the number of integers in the set $\{0, 1, \ldots, n\}$ that are relatively prime to n. Returning to congruences we consider the solution of quadratic congruences, which leads to Gauss's law of quadratic reciprocity. Finally the story of continued fractions is developed and applied as a method of solving further examples of Diophantine equations.

Mathematical logic
In this section we discuss three different abstract notions of computable functions: those arising out of Turing machines, out of Abacus machines and out of the theory of recursive functions. First we show that these notions of computability all give rise to the same class of computable functions, and give evidence towards Church's thesis on computability. Then we look at the formalization of a mathematical language for number theory, and at a formal proof system for it. Finally, the material so far is combined to give proofs of Gödel's incompleteness theorem, a result of great philosophical importance for the limits of mathematical endeavour.

Advice to applicants

The course assumes no mathematical knowledge beyond A-level in pure mathematics (Higher Grade in Scotland), but many of the concepts require considerable mathematical sophistication.

Preparatory work

You could do some preliminary reading from the set book (Boolos and Jeffrey, chapters 1, 3, 6 and 7), though the course texts provide much explanatory material to supplement even the earliest chapters of the book.

If you are disabled

This course may present substantial difficulties if you have impaired sight, but it is not impossible. Printed materials have not yet been recorded for the number theory half of the course, which has just been revised, but there are recordings and transcripts of all the mathematical logic materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts

Cassettes
Three audio cassettes

You will need to buy

Set book
G. S. Boolos, R. C. Jeffrey *Computability and Logic*, 3rd edition, Cambridge University Press, £16.95
(1996 price)

You will also need

Audio cassette player
A calculator would be useful, though it is not essential. A simple four-function $(+, -, \times, \div)$ model would suffice.

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score' calculated as a weighted average of all your scores for the course. In M381 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It can also count towards the University's MMath degree.

Related courses
Because the subject-matter of M381 overlaps with the discontinued courses M335 and M382–5, you can count only one of the group towards a BA or BSc.

Professional recognition
This course can in some circumstances help you towards a professional qualification. You can find out more in our Recognition Information leaflet:
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
You can get this from your Regional Centre.

M381/382

MATHEMATICAL METHODS AND FLUID MECHANICS

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

This course introduces the fundamentals of fluid mechanics and discusses the solutions of fluid flow problems that are modelled by differential equations. Half the course is about modelling simple real fluid flows and the other half about the mathematical methods associated with models. The methods arise from and are interpreted in the context of fluid flow problems although they can also be applied in other subjects such as electromagnetism and the mechanics of solids.
In simple terms we think of a fluid as a substance that flows. Examples of fluids that are very familiar are air (a gas) and water (a liquid). All fluids are liquids or gases. The analysis of the forces in and motion of liquids and gases is called fluid mechanics.
Because of its many applications fluid mechanics is important for applied mathematicians, scientists and engineers. The flow of air over objects is of fundamental importance to the aerodynamicist in the design of aeroplanes and to the motor industry in the design of cars with drag-reducing profiles. The flow of fluids through pipes and channels is also important to engineers. Fluid mechanics is essential to the meteorologist in studying the complicated flow patterns in the atmosphere.
Each of the fourteen course texts is introduced by a study guide with advice about how to work through it. At two points in the course there are study weeks without texts, set aside so that you can consolidate what you have learnt so far before going on. These weeks each have an exercise booklet to help you to review your work. A two-hour video cassette shows many of the features of a fluid in motion that are described mathematically in the printed texts, so that you not only learn to do the mathematics but also see what they are trying to model. The video booklet gives brief descriptions of the experiments and fluid flows shown on the cassette.
The course is arranged in four blocks. The first is the foundation on which the rest of the course is built. *Properties of a fluid* introduces the continuum model and many of the properties of a fluid such as density, pressure and viscosity. The basic equation of fluid statics is formulated and used to find the pressure distribution in a liquid and to provide a model for the atmosphere.
Boundary value problems develops the solution of second-order ordinary differential equations, discussing analytical and numerical approaches to solving boundary value problems.
The next text is divided into two parts. The first introduces the idea of a partial differential equation and investigates the solution of *first-order partial differential equations*. The second part introduces the technique of *dimensional analysis* for finding possible relationships between variables.
Vector field theory relates line, surface and volume integrals through two important theorems, Stokes' theorem and Gauss' theorem, and formulates the equation of mass continuity for a fluid in motion.
The second block starts by investigating the motion of a fluid that is assumed to be incompressible (it cannot be reduced into a smaller volume) and inviscid (there is no internal friction). All real fluids do exhibit some form of compressibility and viscosity, and the effect of viscosity on the flow of fluids is investigated towards the end of the block.
Kinematics of fluids introduces the equations of streamlines and pathlines, develops the concept of a stream function as a method of describing fluid flows and formulates an important equation of motion for an inviscid fluid, Euler's equation.
Bernoulli's equation, resulting from integrals of Euler's equation, is presented in various forms relating to pressure, speed and potential energy for the flow of an inviscid fluid. Bernoulli's equation is used to investigate phenomena such as flows through pipes and apertures, through channels and over weirs.
Vorticity discusses two important mathematical tools for modelling fluid flow, the vorticity vector and circulation. We describe the flow of a fluid past a cylinder, showing the diffusion of vorticity and its convection along with the uniform flow, and discuss the effects of viscosity on the flow of a real (viscous) fluid past an obstacle.
Flow of a viscous fluid establishes the equations of motion of a viscous fluid, and investigates some of their exact solutions and some of the simplifications that can be made by applying dimensional arguments.
Block 3 looks at the theory of partial differential equations. *Second-order partial differential equations* shows how a second-order partial differential equation can be classified as one of three standard types, and how to reduce an equation to a standard form. We introduce the method of separation of variables for the diffusion equation as a method of solving partial differential equations.
Fourier series and power series discusses two methods of approximating a function: using Fourier series and power series. The power series method can be used to solve differential equations that could otherwise be solved only numerically. Fourier series have an important application in the solution of partial differential equations.
Sturm-Liouville theory introduces a general ordinary differential equation and associated boundary conditions, a Sturm-Liouville problem, examples of which occur in the solution of partial differential equations by the method of separation of variables.
Laplace's equation is a particular second-order partial differential equation that can be used to model the flow of an inviscid fluid past a rigid boundary. We find solutions of Laplace's equation and interpret them in the context of fluid flow problems, for example, the flow of a fluid past a cylinder and a sphere.
The last block is about waves. *The wave equation* deals with some of the methods of solution of the wave equation and gives examples of its occurrence as a model for various physical situations involving vibrations. *Water waves* uses the solutions we have just found to investigate various types of water wave, and discusses several practical examples of these waves.

Advice to applicants

You must be familiar with first-order and second order ordinary differential equations, the solution of linear simultaneous equations, vectors and elementary vector calculus, partial differentiation and basic particle (Newtonian) mechanics. The course includes a revision booklet with worked examples and exercises to help you to revise the necessary mathematical methods before the course begins. Studying the later units of the Level 2 course MST204

Mathematical models and methods on partial differentiation and partial differentiation equations, vector calculus, multiple integrals and Fourier analysis would be a good preparation. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

Your local library should be able to suggest books that cover the topics mentioned in *Advice to applicants*.

If you are disabled

The course relies heavily on flow visualization and manipulation of complicated mathematical symbols that are difficult to describe verbally, so there are no recordings of printed material or transcripts of the video programmes or audio cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it. If you need recordings of the texts or you are likely to have difficulty with the video part of the course, ask your Regional Centre for advice.

Course materials

Printed material
Fourteen study texts
Course guide and handbook
Revision booklet
Two exercise booklets
Video booklet

Cassettes
One video cassette, with a booklet giving brief descriptions of the experiments and fluid flows shown on the cassette
Audio cassettes

You will need

Audio cassette player
Video cassette player (VHS)

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MST322 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. It is recognized by the Institute of Physics and by many of the professional engineering institutions. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

For the future

MST322 is presented in odd-numbered years only.

MST324 GRAPHS, NETWORKS AND DESIGN

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

What kinds of code are used by spacecraft in communicating with Earth? Where do you brace a rectangular framework to make it rigid? How many colours are needed to colour a map so that neighbouring countries are different? Can you tile a floor with twelve-, six- and four-sided shapes? How can you assign people to jobs for which they are qualified? How many refrigerators can a manufacturer send to a warehouse without overloading any of the routes? These are some of the questions that will be answered in the course. The problems range from those arising in present-day technology, operational research and the physical and social sciences to puzzles of a more recreational nature. Throughout the course we try to show the connections between seemingly different problems in widely differing areas and to describe common methods for their solution. The material is presented in a down-to-earth manner, with the emphasis on solving problems and applying algorithms rather than on abstract ideas and formal proofs, and your computer will be particularly important for this. The course pays particular attention to the modelling of problems using mathematical ideas, and the representation of these ideas by means of diagrams. The word 'graphs' in the course title refers to any diagram consisting of points joined by lines. These points may correspond to chemical atoms, towns on a map, electrical terminals, or any other things that can be connected in pairs; the lines may be chemical bonds, roads, wires or other connections.
The course is divided into three related subject areas: graphs, networks and design. The *Introduction* introduces two of the main themes of the course, combinatorics and mathematical modelling, and illustrates them with many examples from the three subject areas.
Graphs 1: graphs and digraphs discusses the properties of graphs and digraphs in general, and describes some applications including the use of graph theory in chemistry, genetics, ecology, and music, and the use of digraphs in the social sciences. We also discuss Eulerian and Hamiltonian graphs and related problems; one of these is the well-known Königsberg bridges problem.
Networks 1: network flows is concerned with the problem of finding the maximum amount of a commodity (gas, water, passengers) that can pass between two points of a network in a given time. We give an algorithm for solving this problem, and discuss important variations that frequently arise in practice.
Design 1: geometric design is concerned with various geometric configurations and their occurrence and use in different contexts. It discusses two-dimensional patterns, such as tiling patterns, and considers the construction and properties of regular and semi-regular tilings, and some related packing problems. There is also a discussion of polyominoes and polyhedra.
Graphs 2: trees Trees are graphs that occur in areas such as branching processes, decision procedures and the representation of molecules. After discussing their mathematical properties we look at their applications, such as the minimum connector problem and the travelling salesman problem.
Networks 2: optimal paths How does an engineering manager plan a complex project encompassing many activities? This application of graph theory is called 'critical path planning'. It is one of the class of problems in which the shortest or longest paths in a graph or digraph must be found. In particular, this section looks at problems involving the scheduling activities for complex industrial processes.
Design 2: kinematic design The mechanical design of table lamps, robot manipulators, car suspension systems, space-frame structures and other artefacts depends on the interconnection of systems of rigid bodies. This section discusses the contribution of combinatorial ideas to this area of engineering design.
Graphs 3: planarity and colouring When can a graph be drawn in the plane without crossings? Is it possible to colour the countries of any map with just four colours so that neighbouring countries are coloured differently? These are two of several apparently unrelated problems considered in this section, which have applications to the design of printed circuits and the scheduling of rubbish collection.
Networks 3: assignment and transportation If there are ten applicants for ten jobs and each is suitable for only a few of the jobs, in what conditions is it possible to fill all the jobs? If a manufacturer wants to supply several warehouses with a product made in several factories, how can the warehouses be supplied at the least cost? These are problems of the systems management type that are answered in this section.
Design 3: design of codes Redundant information in a communication system can be used to overcome problems of imperfect reception. In formal terms, we can code information before transmission so that a receiver can both detect and correct errors. This section discusses the properties of certain codes that arise in practice, in particular cyclic codes and Hamming codes, and some codes used in space probes.
Graphs 4: graphs and computing describes some important uses of graph theory in computer science. Among the topics are tree-searching methods, such as depth-first search and breadth-first search, and the knapsack and travelling salesman problems.
Networks 4: physical networks A set of mechanical linkages, such as those in a car suspension system, can be considered as a complex system. Graph theory provides a unifying method for studying these systems, such as finding the current through an electrical network or water-flow through pipes. This section describes the graphical representation of physical networks.
Design 4: block designs If an agricultural research station wants to test different varieties of a crop, how can a test-field be designed so that a strip of less fertile ground across it will not bias the results? The answer to this kind of problem lies in the study of block designs. This section explains the concepts of balanced and resolvable designs and gives methods of constructing block designs.
The *Conclusion* summarizes and brings together many of the ideas discussed throughout the course.

Advice to applicants

This interfaculty course is intended for students with a variety of backgrounds. Those who are more mathematically inclined will see how their mathematics can be used to solve problems, while those with a technological interest will learn to appreciate the use of a mathematical framework to relate different ideas. You should consider taking 60 points' worth of courses in mathematics, technology or science before this one. In particular it would be an advantage to have met matrix multiplication and the matrix formulation of simultaneous equations, although these are reviewed in the course. You could get a suitable preparation from MU120 *Open mathematics*, MS284 *An introduction to calculus* or TM282 *Modelling with mathematics: an introduction*. The Enquiry and Admission Service at your Regional Centre will be able to tell you where you can see reference copies of these, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.
Don't worry if you haven't studied any technology before. As long as you rely on common sense and are willing to accept certain statements of a scientific or technological nature, you should have no particular difficulty. Whatever your previous experience you should find plenty to interest you, as long as you are willing to go along with the interdisciplinary nature of the course.

If you are disabled

The many diagrams in the text and the computing element could cause difficulties if you have impaired sight, and we are trying to find ways of overcoming this. Transcripts of the audio cassettes can be provided but there are no recordings of printed course material. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Fourteen study texts
Course guide
Computer booklets
Handbook
Notes to accompany the television programmes and audio cassettes

Broadcasts and cassettes
Seven television programmes
Four audio cassettes

Software
The software includes both teaching and application packages, and will help you with the analysis, exploration and manipulation of graphs, networks and design.

You will need

Television
Audio cassette player
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In MT365 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of MT365 overlaps with the discontinued course TM361, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Water Management*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
You can get these from your Regional Centre.

MT365 DIFFERENTIAL GEOMETRY

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

The course develops the interaction between linear algebra and differential calculus in order to study the main ideas and examples of classical differential geometry, using modern mathematical techniques where they simplify or clarify the exposition. All the curves and surfaces studied are in three-dimensional Euclidean space and so can be readily visualized and explicitly

described in terms of standard functions. The course is based on the set book, with a combined course guide and reminder of the mathematics you are expected to be already familiar with. The six parts of the course cover the first six chapters of the set book. *Chapter I* extends the basic ideas of linear algebra and differential calculus to deal with vector fields, directional derivatives, differential forms and derivative mappings. An additional section deals with the chain rule.

Chapter II studies curves in terms of their tangent, normal and binormal vector fields. This Frenet frame leads to definitions of the curvature and torsion of a curve. Techniques for calculating these are developed and they are shown to reflect the geometry.

Chapter III studies mappings that preserve distance – isometries – and shows that if two curves have the same speed, curvature and torsion then there exists an isometry mapping one to the other.

Chapter IV shows how surfaces can be described in terms of co-ordinate patches. Typical surfaces are the sphere, the torus and the helicoid. Tangent vectors are constructed and used to describe calculus on a surface.

Chapter V uses the calculus to define the shape operator of a surface. This is a linear mapping on tangent vectors and can be represented by a 2 2 matrix. This matrix is used to define the Gaussian curvature (the determinant) and the mean curvature (the trace), and the principal directions (the eigenvectors). Formulae for calculating these are found and their relationship with the geometry of the surface and special curves (principal curves, asymptotic curves and geodesics) is discussed.

Chapter VI is about which properties of a curve are intrinsic, that is, which depend on the internal structure of the surface and not on how we describe them as subspaces of a larger space. We show that Gaussian curvature is such a property, and obtain an alternative method of calculating it.

Advice to applicants

The course assumes that you have already met certain basic mathematical concepts and techniques. Some of these are briefly reviewed in the course, but it is still advisable to have some familiarity with them before you begin. They are:

- Vector spaces, especially R^2 and R^3. Bases and co-ordinates.
- Dot (or scalar) product; lengths and angles. Orthogonality. Orthonormal bases, orthonormal expansion.
- Linear transformations between vector spaces. Representation of a linear transformation by a matrix.
- Determinants. Calculation of determinants of 3 3 matrices.
- Cross (or vector) product.
- Definition of characteristic values and characteristic vectors (eigenvalues and eigenvectors) of a linear transformation (of a vector space to itself)
- Isometries: translations, rotations, reflections. Orthogonal matrices.
- Standard functions: polynomials, exp, log, cos, sin, tan, cosh, sinh. Properties of these functions and functions made up from them. Graphs of such functions. Differentiation of such functions.
- Trigonometric identities, especially $\cos^2 x + \sin^2 x = 1$. Corresponding identities for cosh and sinh: $\cosh^2 x - \sinh^2 x = 1$.
- Integration of simple functions
- Partial differentiation. Calculation of partial derivatives of functions of two or three variables. (There is a brief review of these ideas in the course guide.)

You could get all this from the Level 2 courses M203 *Introduction to pure mathematics* and MDST204 *Mathematical models and methods*. Your Regional Centre will be able to tell you where you can look at reference copies, or you can buy selected materials from Open University Educational Enterprises Ltd, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you would like to acquaint yourself with some of the main elements of the course, the first chapter of the set book gives a good introduction.

If you are disabled

The course is not recommended if you have impaired sight, because diagrams in the set book are used in the assignments and recordings of printed course materials are not available at present. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed materials
Six study texts
Course guide

You will need to buy

Set book
B. O'Neill *Elementary Differential Geometry*, Academic Press, £24.00
(1995 price)

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In M434 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It can also count towards the University's MMath degree.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institute of Hospital Engineering. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
You can get these from your Regional Centre.

For the future

After 1997, this course will not be presented again until 2001.

M363

COMPUTER PROJECT: PROGRAMMING AND PROGRAMMING LANGUAGES

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This is one of three computer project courses. It is based on M353 *Programming and programming languages* and is designed to:

- Give you an opportunity to present a well structured written account of the processes of applying appropriate techniques and methods together with findings from the study.
- Give you experience in planning and scheduling a project.
- Provide an opportunity to apply concepts and skills you have already learnt to a large computing task.
- Provide practical work in an area of computing for which you have studied much of the theory.
- Encourage reflection on the processes involved in carrying out such a piece of work.

You will have just one project to work on. Its topic is specified by the course team and will be based on the content of M353 *Programming and programming languages*. Any additions to the content of that course will be minimal and will be included as part of the project specification. A different project is specified each year. A typical project might be, for example:
The Universal Triple Machine (UTM)

This was proposed as a machine capable of representing and manipulating any kind of information about the 'real world'. It consists of two stores: the name store, which captures the fundamental entities or objects of the real world, and the triple store, which captures the relationships between these objects.
For the project you would be required to develop a computer model of the UTM as a database engine and carry out a simple demonstration of its application to a particular problem. For the first assignment you would be asked to form the abstract data type specifications. The second assignment would require an implementation of UTM using Pascal, presented as a Pascal source listing. Finally, you would be required to present a full report on the project.
If you would like to look through some completed projects please ask your Regional Centre, where there are reference copies of sample project reports.

Advice to applicants

You are expected to have taken M353 *Programming and programming languages* before this course, and we strongly recommend that you should have gained a Grade 1 or Grade 2 pass. We also recommend taking at least one of the related courses M355 *Topics in software engineering* and M357 *Data models and databases* before M453. (The other two computer project courses are based on these.) If you do not take M353 and M453 in consecutive years, you might need to do some revision before starting the project.
It may be necessary to limit the number of places for this course. If so, priority will be given to students who hold, or will hold if they pass the courses they are taking in 1996, at least 300 points including at least 90 at Level 3. 60 points should be from M353, M355 or M357. These students will be eligible for the award of an honours degree if they pass M453. If you do not meet the criteria your application will be considered individually by the Examination and Assessment Board.
An *Assignment Booklet* is sent out in September to all students who have made a reservation for the course. If the selected project does not appeal to you, you have the opportunity to change to another project or to another course. If you register for this course there will be a compulsory meeting with your tutor, probably in June, to discuss the project work. If that is likely to give you any difficulty please consult the staff tutor in maths and computing at your Regional Centre. If you have any doubt about taking the course please seek advice from your Regional Centre.

If you are disabled

The project work is technically similar to the work in M353, so if you have completed that successfully you should find no additional difficulties. If you need recordings of the printed materials on audio cassette please ask the Office for Students with Disabilities, PO Box 79, The Open University, Walton Hall, Milton Keynes MK7 6AR at least six months before the course begins. If you have any other concerns, please telephone the M453 course manager, 01908 652333. Please ask your Regional Centre for our booklet *Meeting your Needs* if you haven't already got it.

Course materials

Printed material
Sample project reports
Guidelines
Model log book
Log sheets

You will need

M353 course materials
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are three tutor-marked assignments, which you must complete. The third, which takes the place of an examination, is a report on the project.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of M453 overlaps with the other computer project courses M455 and M457, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances count towards the admission requirements of the Institution of Electrical Engineers, and it could give you exemption from the British Computer Society Part I project. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

M453

COMPUTER PROJECT: TOPICS IN SOFTWARE ENGINEERING

This is a 30-point course at Level 3.
It has no residential school and requires no computing equipment.

The course

This is one of three computer project courses. It is based on M355 *Topics in software engineering* and is designed to:

- Give you an opportunity to present a well-structured written account of the processes of applying appropriate techniques and methods together with findings from the study.
- Give you experience in planning and scheduling a project.
- Provide an opportunity to apply concepts and skills you have already learnt to a large computing task.
- Provide practical work in an area of computing for which you have studied much of the theory.
- Encourage reflection on the processes involved in carrying out such a piece of work.

You will have just one project to work on. Its topic is specified by the course team and will be based on the academic content of M355 *Topics in software engineering*. Any additions to the content of that course will be minimal and will be included as part of the project specification. For this project you will be given a brief description of a real situation such as distribution from a warehouse, a booking system for an airline or a section of an electronics company. The first piece of set work will ask you to specify the system using data-flow diagrams. The second will require you to write part of a VDM specification for the system. Finally you will be asked to expand the work in the first two assignments and to present a full report on the project.
If you would like to look through some completed projects please ask your Regional Centre, where there are reference copies of sample project reports.

Advice to applicants

You are expected to have taken M355 *Topics in software engineering* before this course, and we

strongly recommend you should have gained a Grade 1 or Grade 2 pass. We also recommend taking at least one of the related courses M353 *Programming and programming languages* and M355 *Data models and databases* before M455. (The other two computer project courses are based on these.) If you do not take M355 and M455 in consecutive years, you might need to do some revision before starting the project.

It may be necessary to limit the number of places for this course. If so, priority will be given to students who hold, or will hold if they pass the courses they are taking in 1996, at least 300 points including at least 90 at Level 3. 60 points should be from M353, M355 or M357. These students will be eligible for the award of an honours degree if they pass M455. If you do not meet the criteria your application will be considered individually by the Examination and Assessment Board.

An *Assignment Booklet* is sent out in September to all students who have made a reservation for the course. If the selected project does not appeal to you, you have the opportunity to change to another project or to another course. If you register for this course there will be a compulsory meeting with your tutor, probably in June, to discuss the project work. If that is likely to give you any difficulty please consult the staff tutor in maths and computing at your Regional Centre. If you have any doubt about taking this course, please seek advice from your Regional Centre.

If you are disabled

The project work is technically similar to the work in M355, so if you have completed that successfully you should find no additional difficulties. If you need recordings of the printed materials on audio cassette please ask the Office for Students with Disabilities, PO Box 79, The Open University, Walton Hall, Milton Keynes MK7 6AR at least six months before the course begins. If you have any other concerns, please telephone the M455 course manager, 01908 652333. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course material

Printed material
Sample project reports
Guidelines
Model log book
Log sheets

You will need

M355 course materials

Assessment

There are three tutor-marked assignments, which you must complete. The third, which takes the place of an examination, is a report on the project.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of the M455 overlaps with the other computer project courses M453 and M457, you can count only one of the three towards a BA or BSc.

Professional recognition
In certain circumstances this course can count towards the admission requirements of the Institution of Electrical Engineers, or give you exemption from the British Computer Society Part 1 project. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

M457
COMPUTER PROJECT: DATA MODELS AND DATABASES

This is a 30-point course at Level 3. It has no residential school and requires a personal computer.

The course

This is one of three computer project courses. It is based on M357 *Data models and databases* and is designed to:

- Give you an opportunity to present a well structured written account both of the processes of applying appropriate techniques and methods and of the findings from the study.
- Give you experience in planning and scheduling a project.
- Provide an opportunity to apply concepts and skills you have already learnt to a large computing task.
- Provide practical work in an area of computing for which you have studied much of the theory.
- Encourage reflection on the processes of carrying out such a piece of work.

You will have just one project to work on. Its topic is specified by the course team and will be based on the academic content of M357 *Data models and databases*. Any additions to the content of that course will be minimal and will be included as part of the project specification. For this project you will be given a description of a sub-system of a real situation such as part of the system for a record shop or a holiday company. For the first piece of written work you will be asked to produce a conceptual data model (an EAR model) with full definitions and descriptions of the components. You will then work on a revised conceptual model in the light of comment from your tutor, and on a list of all the functional dependencies and a relational schema. Both these pieces of work are to be presented as small reports, to give you practice before you submit your project work. Finally you will make a full report that includes the conceptual data model, the logical schema design, the SQL schema, queries and recorded data with implementation and testing.

If you would like to look through some completed projects please ask your Regional Centre, where there are reference copies of sample project reports.

Advice to applicants

You are expected to have taken M357 *Data models and databases* before this course, and we strongly recommend you should have gained a Grade 1 or Grade 2 pass. We also recommend taking at least one of the related courses M353 *Programming and programming languages* and M355 *Topics in software engineering* before M457. (The other two computer project courses are based on these.) If you do not take M357 and M457 in consecutive years, you might need to do some revision before starting the project.

It may be necessary to limit the number of places for this course. If so, priority will be given to students who hold, or will hold if they pass the courses they are taking in 1996, at least 300 points including at least 90 at Level 3. 60 points should be from M353, M355 or M357. These students will be eligible for the award of an honours degree if they pass M457. If you do not meet the criteria your application will be considered individually by the Examination and Assessment Board.

An *Assignment Booklet* is sent out in September to all students who have made a reservation for the course. If the selected project does not appeal to you, you have the opportunity to change to another project or to another course. If you register for this course there will be a compulsory meeting with your tutor, probably in June, to discuss the project work. If that is likely to give you any difficulty please consult the staff tutor in maths and computing at your Regional Centre. If you have any doubt about taking this course, please seek advice from your Regional Centre.

If you are disabled

The project work is technically similar to the work in M357, so if you completed that successfully you should find no additional difficulties. If you need recordings of the printed materials on audio cassette please ask the Office for Students with Disabilities, PO Box 79, The Open University, Walton Hall, Milton Keynes MK7 6AR at least six months before the course begins. If you have any other concerns, please telephone the M457 course manager, 01908 652333. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course material

Printed material
Sample project reports
Guidelines
Model log book
Log sheets

You will need

M357 course materials, including the course software
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are three tutor-marked assignments, which you must complete. The third, which takes the place of an examination, is a report on the project.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of M457 overlaps with the other computer project courses M453 and M455, you can count only one of the three towards a BA or BSc.

Professional recognition
In certain circumstances this course can count towards the admission requirements of the Institution of Electrical Engineers, or give you exemption from the British Computer Society Part 1 project. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

Science Faculty

Undergraduate-level courses offered by the Science Faculty have three main roles:

- To provide a broad coverage of the four science disciplines — biology, chemistry, Earth sciences and physics — so that you can obtain a general degree in science.
- To offer some measure of specialisation at Level 3 in each discipline for those who want an honours degree.
- To make the study of science accessible to everyone who is interested, whether they want a single course or a coherent programme.

The Science Faculty is also developing certain areas of general scientific interest such as health studies, environment, science education and astronomy and planetary science. Science courses can be combined with courses from other faculties to build study routes in these areas. Links between the courses offered by each department, and between science courses and those from other faculties, are shown in the diagrams and in the lists of related courses. Science courses often progress by building on specific skills and knowledge from one course to the next, so you must be particularly careful about making sure that you are well prepared to undertake the courses you choose.

SOME SPECIAL FEATURES OF SCIENCE COURSES

Practical work

Residential schools

Studying science obviously entails doing some practical work, so many courses require attendance at a residential school. Because the practical work for these courses is so important for comprehension of the subject, the University is not generally sympathetic to requests for exclusion from attendance at science residential schools, especially when exclusion has already been granted from a science school.

When a discipline-based residential school serves two related courses (S246 and S247, for example) it is advantageous, though not necessary, to take the two courses simultaneously. The Faculty has produced a booklet that offers guidance to disabled students about science residential schools, which you can obtain from your Regional Centre.

Home kits

Some science courses have home kits for practical work, and some of the kits cannot be sent to certain countries outside the UK. The course descriptions will draw your attention to this, and to any other restrictions on the kit, but please ask your Regional Centre for the latest information.

Ethical issues in biology

The Faculty believes that it is important for students of biology to gain some first-hand experience of experimentation on animals and biological material, but it shares the concerns of students and tutorial staff about the ethical issues that this kind of work raises. Although all the experimental work in the biology departments' research and teaching is subject to Home Office inspection and licensing (where appropriate), this does not fully meet either the Faculty's or the University's ethical concerns. The University's Animal Ethical Committee keeps under review the small amount of research and teaching work that involves animals, and is particularly concerned that the views of students are taken fully into account and, if appropriate, acted upon. The Committee has drawn up a code of practice, which you can get from the Science Deanery.

Alternate presentation of courses

Several science courses are presented in alternate years. The physics department presents two of its Level 3 courses, SM355 *Quantum mechanics* and SMT356 *Electromagnetism* in alternate years as follows:

1997 SM355 available, SMT356 withdrawn
1998 SMT356 available, SM355 withdrawn

S272 *The physics of matter* is presented in even numbered years only.

One course from the chemistry department, S342 *Physical chemistry: principles of chemical change*, is also available in even-numbered years only.

Two related Level 3 courses, S338 *Sedimentary processes and basin analysis* and S339 *Understanding the continents: tectonic and thermal processes of the lithosphere*, which have in the past been presented alternately, will both be presented in 1997 and then every year. We intend to revise and update S338 for 1999.

PREPARING YOURSELF FOR SCIENCE COURSES

Some science courses have been specifically designed to have a broad appeal and to be accessible to a wide range of students. Nevertheless the following advice applies to all courses with S as the first letter of the course code, and is particularly important if you are coming to science study at Level 2 or Level 3 without the background of the foundation course in science.

You should treat the *Advice to applicants* in the course descriptions very seriously. All science courses at Level 2 and Level 3 assume that you have achieved the objectives of the courses specified in the advice and build on them, even if they are not science courses (D103, for example, is recommended for SD206). If you have not passed one of the recommended courses but think that you have acquired the necessary knowledge and skills elsewhere, you should consult your counsellor or the science staff tutor at your Regional Centre to make sure. This advice is especially important if you want to take physics courses, where mathematical competence is stressed for most courses at Level 2 and is essential at Level 3.

Some Level 3 courses, for example S330 and S365, list only topics from the foundation course as assumed knowledge, but the new concepts in these courses are introduced, taught and assessed at Level 3. You are expected to have had experience in at least one related discipline area at Level 2 before making the conceptual jump to these multidisciplinary courses at Level 3.

LEVELS OF STUDY

Level 1

S102 *A science foundation course* is the obvious course to start with if you want to study for a mainly science-based degree and have little or no other grounding in the subject. It introduces, explains and uses many basic concepts of biology, chemistry, Earth sciences and physics, and although it will be within your reach if you have no formal science education it will also present a stimulating challenge for you if you have. Most science courses at higher levels build on S102, so it is a key part of most of the degree routes outlined here.

Level 2

There are several Level 2 courses that provide a gradual transition from S102 to more specialized courses in biology, chemistry, physics and Earth sciences. The diagram on page 19 shows how they fit with S102. If you are interested in more general subject areas or in themes that draw on more than one discipline you might want to consider ST240 *Our chemical environment*, S280 *Science matters* or SD206 *Biology: brain and behaviour*, or, outside the Science Faculty, U205 *Health and disease* (described on page 28) or U206 *Environment* (page 44). The Arts Faculty offers two courses at Level 2 in the history of science: A282 *Science, technology and everyday life 1870–1950* and A8283 *The rise of scientific Europe 1500–1800* (page 28).

Level 3

Moving up from Level 2, courses are grouped mainly according to the four main disciplines, but some, such as S365 *Evolution* and S330 *Oceanography*, offer interdisciplinary study. If you want an honours degree in science you will need at least 120 points at Level 3, so you need to be particularly careful to plan your progression so that you are suitably prepared for the Level 3 courses of your choice.

Project course

The project course S442 *Nuclear magnetic resonance spectroscopy in chemistry and the life sciences* is for students who have a particular interest in chemistry. It offers the opportunity to undertake an independent piece of work towards the end of an honours degree. Only about fifty places are offered each year; the course description explains the entry requirements and will help you to judge whether it is a suitable choice for you.

Diplomas

Certain Science Faculty courses can contribute to the undergraduate-level Diploma in Pollution Control. To obtain the diploma, perhaps on your way to a degree, you need to complete two technology courses:

T237 *Environmental control and public health*
T303 *Environmental monitoring, modelling and control*

and one science course chosen from:

ST240 *Our chemical environment*
S268 *Physical resources and environment*
S280 *Science matters*

The technology courses are described on pages 41 and 47.

Professional recognition

Recognition leaflet 3.8 *Scientific institutions*, available from your Regional Centre, sets out the requirements for membership of institutions such as the Institute of Physics and the Royal Society of Chemistry.

New developments

In 1998 the present foundation course will be replaced by a new introductory course, S103 *Discovering science*. (Unlike the present course, S103 will require access to a personal computer.) We are also developing a taught master's degree programme, which we hope to introduce in 1998. The two broad themes of the programme are likely to be 'science and the public' and 'science and medicine'. We will be able to tell you more about it later this year.

FIGURE 1 Some recommended course choices post Level 1

S102 A Science foundation course

- S203 BIOLOGY: FORM AND FUNCTION — R 60
- S246 ORGANIC CHEMISTRY; S247 INORGANIC CHEMISTRY: CONCEPTS AND CASE STUDIES — RD 30
- ST240 OUR CHEMICAL ENVIRONMENT — Any foundation course can give you entry into ST240. Underpins S246 and S247 in particular, and serves as an introduction to T237. — R 30
- S280 SCIENCE MATTERS — Minimum prerequisite S102. Designed to be taken straight after S102, and would combine with any other course at Level 2 — 30
- S281 ASTRONOMY AND PLANETARY SCIENCE — Minimum prerequisite S102 or T102 or MU120/MST121. Designed to be taken straight after S102, T102 or MU120/MST121. Would combine with any other 30-point course at Level 2, particularly in physics, Earth sciences or chemistry. — 30
- S271 DISCOVERING PHYSICS — R 30
- S236 GEOLOGY — R 30

These courses offer an easier transition from foundation

SUGGESTED ROUTES IN SCIENCE

KEY

Courses at Level 2 which build directly on experience gained at Level 1

Alternative study routes

FIGURE 2 Biology

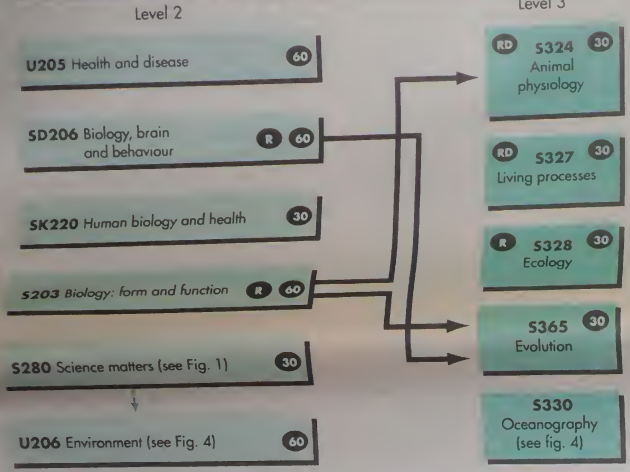


FIGURE 3 Chemistry

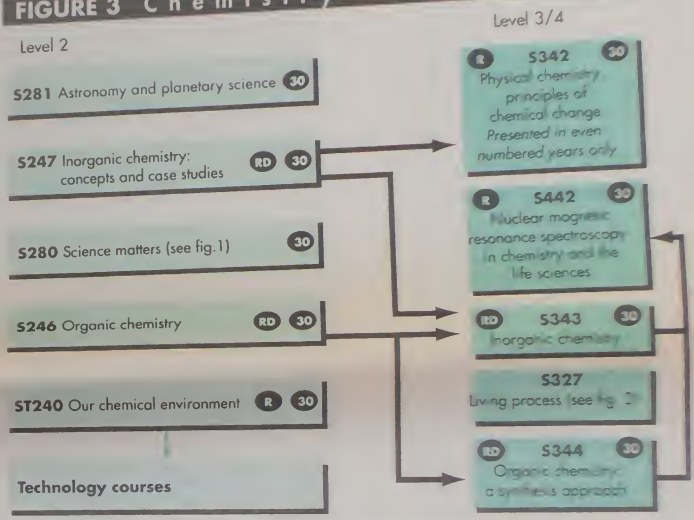


FIGURE 4 Earth Sciences

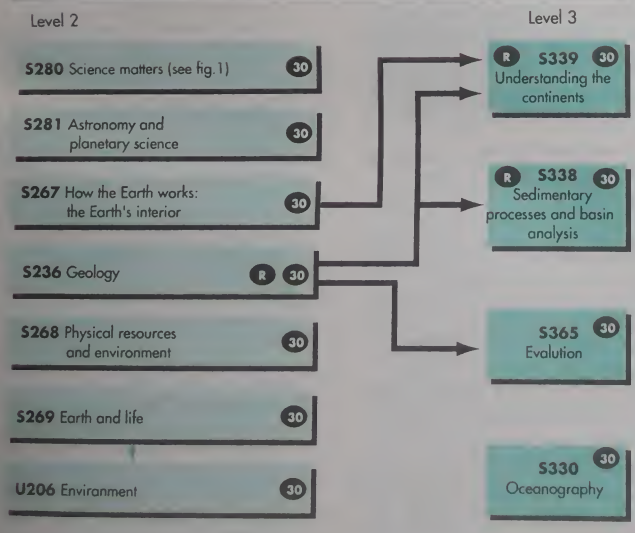
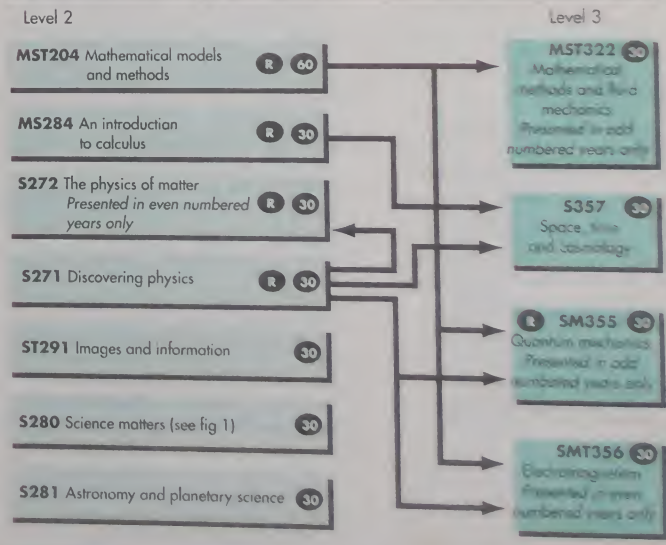


FIGURE 5 Physics



KEY TO SYMBOLS

- R Residential School
- RD Discipline-based residential school
- 30 30-point
- 60 60-point
- Courses at Level 3 which build directly on experience gained at Level 2
- Complementary courses at Level 2

NOTE: For courses not shown linked with arrows, you will find advice on study routes in the course descriptions on pages 20 – 35.

RELATED COURSES IN SCIENCE

Interdisciplinary

S102 A science foundation course 20
S280 Science matters 25
S280 can contribute to the Diploma in Pollution Control. 25

Earth sciences

S236 Geology 21
S267 How the Earth works: the Earth's interior 23
S268 Physical resources and environment 23
S269 Earth and life 24
S330 Oceanography 30
S338 Sedimentary processes and basin analysis 31
S339 Understanding the continents: tectonic and thermal processes of the lithosphere 32
S365 Evolution 34

Some Earth science courses can be combined with other science courses and with technology courses to make up a degree that leans towards environmental sciences, materials science, or astronomical and planetary science. Such combinations include U206, S203, S280, ST240, T237, T334, T247 (environmental sciences); S247, S272, ST240, T203, S342, S343 (materials science); S271, S281, ST291, T292, SMT356, S357 (astronomical and planetary science).

Chemistry

S246 Organic chemistry 22
S247 Inorganic chemistry: concepts and case studies 22
ST240 Our chemical environment 27
S342 Physical chemistry *
S343 Inorganic chemistry: a synthesis approach 32
S344 Organic chemistry: a synthesis approach 33
S442 Directed studies course in chemistry: nuclear magnetic resonance spectroscopy in chemistry and the life sciences 35
U206 Environment 44

*S342 is presented in even-numbered years only.

Physics

S271 Discovering physics 24
S272 The physics of matter *
S281 Astronomy and planetary science 25
ST291 Images and information 27
S357 Space, time and cosmology 33
SM355 Quantum mechanics 34
SMT356 Electromagnetism *
MST322 Mathematical methods and fluid mechanics 14

Physics has close links with mathematics and technology and, depending on the bias you want to give to your degree, you could readily combine courses from the three faculties. The physics department has produced a leaflet about this that you can get by writing to the Director of Teaching, Department of Physics, Science Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA. Please mark your envelope 'Coherent degree profiles'.

*S272 and SMT356 are presented in even-numbered years only, SM355 in odd-numbered years only.

Biology

S203 Biology: form and function 20
S280 Science matters 25
SD206 Biology: brain and behaviour 26
SK220 Human biology and health 26
U205 Health and disease 28
S324 Animal physiology 29
S327 Living processes 29
S328 Ecology 30

Many chemistry and Earth science courses are also relevant to studies in biology.

SK220 and U205 can count towards the Diploma in Health and Social Welfare.

S102

A SCIENCE FOUNDATION COURSE

This is a 60-point course at Level 1, with a one-week residential school.
It requires no computing equipment.

The course

What is genetic fingerprinting and how can it be used? How did the universe begin? What is the greenhouse effect and why could it lead to climatic problems? Why is there a hole in the ozone layer? The course answers these questions, and many others, scientifically. It covers four scientific disciplines – physics, Earth sciences, chemistry, biology – and we show how they are related and what is common and what is specific to each discipline.

The course begins by considering very familiar observations such as the alternation of day and night and the cycle of the four seasons. It explains how these observations can be understood by means of simple scientific models of the solar system. Still using the example of the solar system, we consider in detail the concept of measurement (you will actually measure the distance between the Earth and the moon) before introducing simple scientific laws that enable us to understand motion, force and gravity.

This discussion leads us to consider the Earth itself and in particular its internal structure and composition, which can be investigated in detail through measurements of the effects of earthquakes. We look at the Earth's magnetic field and show how it has changed over time. Then a scientific theory is used to explain many diverse features seen on and within the Earth: for example, why earthquakes and volcanoes are found only in certain zones; why rocks in the Sahara Desert show evidence that they were once covered by glaciers and why the remains of marine animals have been observed in rocks at the top of Mount Everest.

The course then changes direction to study energy and light. This leads to a detailed investigation of the structure of atoms, the 'building blocks' of matter. In the millions of chemical changes that occur around and within us atoms change partners and the different groupings give rise to substances as different as salt, sand, water and petrol. Certain very complex groupings of molecules have properties that allow them to be regarded as living organisms. We discuss which aspects of living matter distinguish it from inanimate (non-living) objects. We learn how organisms become adapted to their environment by a process of evolution, how they grow and reproduce.

The building block of organisms is the cell. Its structure and function are described and illustrated with both plant and animal examples. The discussion of physiology (how organisms work) uses examples of human biology, and this human theme also runs through the discussion of genetic mechanisms. Then you will see how each individual shares the environment with others, and understand how finely balanced that environment is and how easily it can be destroyed. Next, turning our attention to the inanimate matter on the Earth's surface, we show how the ages of rocks, the Earth itself and the solar system can be estimated.

The last part of the course is about the structure and behaviour of atoms and their constituents. This is a subtle and fascinating branch of science in which many of the results of experiments contradict common sense. One of the theories necessary for understanding these extraordinary results is quantum mechanics, which is introduced in non-mathematical terms and then applied to atoms to give insights into atomic structure. Quantum ideas are used again when we look into the recent discoveries of sub-atomic and sub-nuclear physics that have made this branch of science one of the most exciting fields of human endeavour.

Science or diploma

This course is designed both for students who do not expect to study science beyond foundation level, and for those who intend to go on to more advanced science courses. It will be within your reach if you have no formal science education, but it is by no means trivial or superficial. It will present you with a stimulating intellectual challenge even if you already have science qualifications.

Preparatory work

A preparatory package, *Into science*, covering the basic mathematical and science study skills you will need, will be sent to you about four months before the course begins. Working through it carefully will help you to practise the necessary skills and develop confidence in them.

If you are disabled

Printed course material is available on audio cassette, and there are transcripts of the course's broadcasts and audio cassettes. If you have a visual disability, please ask the Office for Students with Disabilities for advice. We will do everything we can to enable students with severe disabilities to take the course, though attendance at the residential school is essential. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Thirty-two study texts

Broadcasts and cassettes
Thirty-five television programmes
Five audio cassettes

Home kit
You will be lent an experiment kit with which you can investigate concepts discussed in the text.

Outside the UK
Because of restrictions on sending the kit overseas, this course is not available in Denmark, Finland, Greece, Italy, Portugal or Sweden.

You will need

Colour television
Audio cassette player
A calculator with simple mathematical functions: multiplication, division, logarithms, sines, cosines and tangents

Residential school

The one-week summer school gives you an opportunity to work intensively on carefully structured experiments in well-equipped laboratories, under the supervision of tutors. There are also tutorials and films, and you will be able to meet students and staff in informal surroundings. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are eight tutor-marked assignments, nine computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S102 this rule can apply to two tutor-marked assignments and four computer-marked assignments. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject matter of S102 overlaps with the discontinued courses S100 and S101, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by the Institute of Biology and the Royal Society of Chemistry, and is also one of the group of courses that gives exemption from the Merchant Navy Extra Master's Certificate. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporations*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

For the future

S102 will be presented for the last time in 1997. It will be replaced in 1998 by S103.

S282

BIOLOGY: FORM AND FUNCTION

This is a 60-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course offers a good introduction to general biology, suitable both for students who do not intend to take the subject any further and for those who want to go on to more advanced biology courses. The aims of the course are:

- To introduce the principles of taxonomy and review the diversity of living organisms.
- To explore the relationship between structure and function in plants and animals and their cells.
- To explore cell/cell interactions and the basic features of differentiation and development in plants and animals.
- To demonstrate the problems of living in selected environments and the physiological and other mechanisms that allow organisms to survive in various physico-chemical conditions.
- To investigate the evolution of physiological mechanisms and to demonstrate the importance of regulation and control in homoeostatic processes.

By the end of the course you should have:

- An awareness of the complexity of living organisms and their diversity of form, structure and physiology.
- Some of the skills appropriate to intending professional biologists.
- The ability to communicate your ideas and conclusions on biological topics and the results of your own investigations.

Three basic themes underlie the course: energy relationships, structure–function relationships and mechanisms of regulation and control. There is a general emphasis on adaptation to environment. The course is presented in five books, each accompanied by a study guide that links the text with experiments, audio cassettes and television programmes.

Book 1 The diversity of organisms The course starts with study of the diversity of organisms and introduces micro-organisms, plants and animals. Some of the biological factors that have promoted and maintained such a huge variety of organisms are examined, and there are examples from recent research that have helped to provide an explanation for diversity. The book ends with a detailed summary of the anatomy, life history and taxonomy of the most abundant and diverse groups of plants and animals. This is intended for reference as you study later books.

Book 2 Cell structure, function and metabolism The unifying features characteristic of all organisms are demonstrated by study of cell structure and function. The dynamics of cell metabolism are examined with special emphasis on enzymes as regulators and cell membranes as regulatable barriers.

Book 3 Animal physiology considers the parts played by hormones and nerve cells in regulation and control of homoeostasis. This is followed by

study of respiratory and circulatory systems, then feeding, digestion, control mechanisms in reproduction and excretion and osmoregulation. There is special emphasis on mammals and insects, but there are many references to other groups of animals.

Book 4 Plant physiology The study of plant physiology begins with plant structure, photosynthesis, ion uptake and transport of nutrients, followed by water relations. Cell growth and development in plants are illustrated by consideration of the life-cycle of flowering plants from germination to seed production.

Book 5 Development Developmental biology follows, with a discussion of the processes of growth, cell differentiation and morphogenesis in terms of the properties of cells and their interactions, which result in the integrated form and function of the mature organism.

Advice to applicants

You are likely to find parts of *Biology: form and function* quite difficult if you come to it with no knowledge of biology. S102 *A science foundation course* would bring you to an appropriate level to start from; your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. Units 4 and 19–26 are particularly relevant. Or you could study a modern textbook of biology such as *The Chemistry of Life* by S. P. R. Rose (third edition, 1991, Pelican).

If you are disabled

You could probably cope with all essential parts of the course, including the experiments, as long as you have adequate help, though if you have a serious visual disability you are likely to find particular difficulties with the microscope work at the residential school. Printed course material is available on audio cassette and there are transcripts of the broadcasts and the course's audio cassettes. *Please ask your Regional Centre for our booklet Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five books, each with a related study text that includes a guide to the week's work
Notes to accompany the broadcasts
Notes to accompany the audio cassettes
Experiment notes

Broadcasts and cassettes
Thirty television programmes
Five audio cassettes

Experiment kit
We regard doing experiments as an essential part of the training of a natural scientist. There are eight investigations to be carried out in parallel with the five books. Some are closely related to particular chapters and should be carried out in the appropriate study week. Others are carried out in specified 'experiment weeks'. The experiments investigate membrane permeability, respiration of blowfly maggots, the structure and function of a pig's heart, water retention in potato strips and the effect of a plant growth regulator on the growth of cucumber seedlings. Other experiments involve histology, the study of tissues, so you need to learn how to use the microscope and to interpret microscopic preparations on slides and in photographs of tissues from animals and plants. There will be questions on the home experiments in the work you do for your tutor and perhaps in the examination.

If you have not done experimental work before you might find it helpful to obtain Unit 4 Practical Work in Science from S102 *A science foundation course*; this explains in general terms how to record and analyse results, and gives advice on how to make certain measurements.

Outside the UK

Because of restrictions on sending the kit the course is not available in Denmark, Finland, Gibraltar, Greece, Italy, Portugal or Sweden.

You will need

Colour television
Audio cassette player

Residential school

A one-week summer school at Nottingham University gives you an opportunity to carry out experiments using more sophisticated techniques than are possible with the home kit. There will be three experimental blocks, and you will be expected to tackle all three. Part of this work will use tissues from invertebrate larvae and rats. Work at the residential school is tested in a computer-marked assignment. There will be other optional activities, tutorials and a guest lecture. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are eight tutor-marked assignments (the first will not count towards your course result), five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S203 this rule can apply to two tutor-marked assignments and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S203 overlaps with parts of the discontinued courses S22_, S2_1, S205 and S202, you can count only one of the five towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from professional bodies including the Institute of Biology. You can find out more in our Recognition Information leaflets:

3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

GEOLOGY

This is a 30-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course offers a practical introduction to geology. It concentrates on the geology of Britain, and will be of interest to everyone who wants to know more about the geological framework of the landscape.

The course introduces the practical techniques used by geologists; shows the variety of rocks found in the Earth's crust and how they can be described and classified; discusses the processes that produce these rocks and how the environments in which they formed can be deduced; describes and classifies representatives of the main fossil groups; and shows how fossils can be used to work out the environment and age of the rocks in which they occur. The course is divided into six parts.

Maps is mainly concerned with the interpretation of geological maps. It starts by showing how such maps have developed over the past two hundred years, and then considers the relationship between the landscape and the underlying rocks by looking at several different areas of Britain. The last and most important sections show in detail how the geological history of an area can be interpreted from a geological map.

Earth materials explores the nature of common rocks and minerals and introduces the techniques for describing and identifying them, including the use of the polarizing (petrological) microscope.

Internal processes describes the formation of igneous rocks, which involves crystallization from a molten liquid or magma, and the formation of metamorphic rocks by the recrystallization of rocks under high temperatures and pressures. It also discusses how rocks can be deformed by folding and faulting.

Surface processes describes the physical and chemical processes that erode the land and lead to the formation of sedimentary rocks.

Fossils deals with the evidence of life in the past. It describes the main groups that make up the fossil record, and how fossils can be used to identify past environments and correlate strata from different areas.

Historical geology summarizes the geological history of the British Isles and the surrounding region. It uses the practical skills explained in the course to interpret events of the remote past from the fragmentary evidence found in rocks today.

Advice to applicants

You are expected to have a sound science background and to be familiar with the terms, concepts and principles introduced in S102 *A science foundation course*. *Geology* contains several references to that course, although terms are usually redefined when they are important, and a glossary is provided. Your Regional Centre will be able to tell you where you can see reference copies of the foundation course, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

The most useful preparation is to make yourself familiar with modern geological principles and terminology by reading the Earth science units (5–6, 7–8, 27 and 28–29) from S102 *A science foundation course*. These cover geological topics such as plate tectonics, earthquakes, minerals, rocks and fossils. Two rather nice general introductory texts are *The Earth: An Introduction to Physical Geology* by E. J. Tarbuck and F. J. Lutgens, published by MacMillan, and *Understanding Earth* by F. Press and R. Siever, published by W. H. Freeman and Co.

If you are disabled

There is a lot of detailed work with small hand-specimens of rock and fossils, and the microscope and map work require good visual acuity and the ability to distinguish colours. Printed course materials are available on audio cassette and there are transcripts of the television programmes and course cassettes. The residential school fieldwork, which is an essential part of the course, is likely to be extremely difficult if your mobility is significantly restricted and some of it will be impossible in a wheelchair, but you should not be deterred from taking the course. You can get more information and advice from the course manager, telephone 01908 654809. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six study texts
Colour plate booklets
Reference handbooks
Notes to accompany the broadcasts
Glossary

Home kit
The course includes extensive practical work with a home kit, which is used from the beginning of the course. The kit contains a petrological microscope, rock and mineral specimens, rock thin sections, fossil casts, maps, a hand lens and a compass clinometer.

Outside the UK

You will need to provide a mains lead for the microscope.

Broadcasts and cassettes
Sixteen television programmes. Each programme is accompanied by notes, and it is important to read them before the programme.
Four audio cassettes

You will need to buy

British Geological Survey: Geological Survey Ten-mile Maps 1:625000 Britain: *North* (solid, 3rd edition); Ordnance Survey, £9.95
British Geological Survey: Geological Survey Ten-mile Maps 1:625000 Britain: *South* (solid, 3rd edition); Ordnance Survey, £9.95
(1996 prices)
You will need these maps from the beginning of the course, so you must buy them soon to good time. You can get them from Ordnance Survey agents and stockists (most bookshops), from the bookshop at the Geological Museum, South Kensington (part of the British Museum of Natural History) or by post from The British Geological Survey, Keyworth, Nottinghamshire, NG12 5GG, telephone 0115 936 3241. An order form, enabling you to a 25 per cent discount will be sent in the first course mailing. If you want to buy the maps in advance at the reduced price you will need an application form from the course manager, telephone 01908 654809.
You will also need a hard hat, which will cost less than £5, for the field trips. You will be sent more information in the first course mailing.

You will also need

Television (preferably colour)
Audio cassette player

Residential school

The one-week residential school is usually held at the University of Durham in July or August. A choice of weeks is always offered. The week's programme consists of fieldwork at a variety of sites in northern England, supported by laboratory and tutorial sessions. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, three computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S270 this rule can apply to one tutor-marked assignment, one computer-marked assignment and the examination. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S270 overlaps with the discontinued course S23_, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. You can find out more in our Recognition Information leaflets:

3.5 *Membership of professional bodies: Institute of Wastes Management*

You can get these from your Regional Centre.

For the future

We hope to produce a new version of the course for 2000.

ORGANIC CHEMISTRY

This is a 30-point course at Level 2, with a one-week residential school.
Use of a personal computer is optional.

The course

Organic chemistry is a subject that affects our lives in many different ways. Living things are largely composed of organic materials. Many fabrics are made from synthetic organic compounds. The pharmaceutical industry is almost completely dependent on organic chemicals. A knowledge of organic chemistry is essential to an understanding of these and other aspects of everyday life, and this course gives an introduction to it. An important aim is to show how problems in such diverse areas as petrochemicals, polymers, biological systems and pharmaceuticals can be tackled using the basic principles of organic chemistry. The course is designed to:

- Introduce the subject of organic chemistry, and to classify organic compounds using the functional group approach.
- Help you to understand the shapes of molecules, and illustrate the relationships between molecules in three dimensions (stereochemistry).
- Describe and discuss the techniques used to separate and identify the components of organic mixtures, and develop skills in the spectroscopic identification of organic compounds.
- Account for the shapes of molecules, the nature of chemical bonds and, through a discussion of the thermodynamic and kinetic aspects of chemical reactions, the molecular stability of organic compounds.
- Discuss the classifications of organic reactions and their mechanisms, and describe the application of these concepts to rationalize the characteristic chemical reactions of aromatic compounds, carbonyl compounds and certain types of organometallic compounds.
- Suggest the importance of organic synthesis in the past, present and future, and outline the principles and considerations that govern the planning and carrying out of a successful synthesis.

Organic compounds, patterns and shapes The course begins with a look at organic chemistry in the environment through the 'carbon cycle', discussing the sources of organic compounds and showing how such organic compounds are obtained from crude oil, which is a complex mixture. Since there are more than four million known organic compounds, it is necessary to classify them. One way of doing this is to use the functional group approach, which is explored through a home experiment. Stereochemistry, which is concerned with the three-dimensional arrangement of atoms in molecules, is outlined with the help of molecular models. Through the functional group approach and stereochemistry, the chemistry of some drugs that act on the nervous system is examined and related to their biological function.

Exploring molecular structure Chemistry is concerned with the change of one substance into another. In order to establish that a chemical change has occurred, we need to know if a new substance has been formed. This section discusses the various ways of isolating and identifying new compounds. An example of chromatography is illustrated by a home experiment. Another technique, spectroscopy, is described, with plenty of examples to show how the interaction of electromagnetic radiation with various chemical substances allows molecular identification. Infrared spectroscopy is particularly useful for the identification of functional groups, since each group absorbs energy at a characteristic frequency. The most powerful routine spectroscopic technique is nuclear magnetic resonance spectroscopy, which gives information about a carbon nucleus in a particular environment and about the presence of neighbouring functional groups. The emphasis here is on a complete understanding of the underlying theory. Since chemical reactions are about bond making and bond breaking, we examine the bonding in carbon compounds and its influence on the shapes of molecules and the reactivity of the reactants.

Understanding reactions The classification of organic reactions into substitution, addition and elimination reactions is discussed, and the different ways in which reactions can proceed are investigated both at the molecular level and from a mechanistic point of view. We also look at the factors that determine the type of reaction that will occur when both substitution and elimination reactions are possible. Finally we introduce synthesis, examining how specific drug molecules can be constructed. Our knowledge of mechanism helps towards an understanding of the stereochemistry of the product(s). A home experiment investigates the kinetics of a substitution reaction.

Developing functional group chemistry The concept of reaction mechanism is developed in order to rationalize the behaviour of other functional groups. The many reactions of benzene and aromatic compounds can be explained through the mechanism of electrophilic aromatic substitution. The reactions of some carbonyl compounds can be categorized according to the mechanism that is involved. New carbon-carbon bonds can be formed when carbonyl compounds are reacted with organometallic reagents, which are commonly used in organic synthesis. The application of mechanism is further developed in the study of polymers, their properties, syntheses and applications.

Creative organic chemistry brings together the different aspects of organic chemistry: the functional group approach, stereochemistry, separation and purification, analytical and spectroscopic techniques, and the mechanistic approach to the understanding of chemical reactions. These are applied to the synthesis of organic chemicals. Some chemical reactions that are useful in synthesis are presented and the planning and execution of a synthesis are described in detail. The theoretical and practical implications are also discussed. The course ends with terpenes, the substances that are often responsible for the characteristic odour and flavour of plants. Their chemical and biochemical syntheses are compared.

Advice to applicants

You are expected to have some background knowledge of chemistry, biology, physics and Earth sciences.

Preparatory work

You could read the chemistry section, Units 11–18, of S102 *A science foundation course*. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. You could also watch some of the foundation course television programmes; please ask the Central Enquiry Service, PO Box 200, The Open University, Walton Hall, Milton Keynes, MK7 6YZ for the S102 Study Calendar, which gives the dates and times of transmissions.

If you are disabled

Although there is a fair amount of experimental work to be carried out at home and at the residential school, you should not be discouraged from taking this course, though if you have a *severe* visual disability or *severe* restriction of mobility or manual dexterity you may find some parts of the course very difficult. Printed course material is available on audio cassette and there are transcripts of the television programmes and video cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five study texts

Broadcasts and cassettes
Eight television programmes
Three audio cassettes
Two video cassettes

Home kit
You will receive an experiment kit (to be returned at the end of the course) to use at home. Chemistry is an experimental science and the five experiments have been designed as an integral part of your study, so it is important that you do them at the appropriate times. Some of the work for your tutor will be based on the results of your experiments.

Outside the UK

Because of restrictions on the kit this course is available only in Austria, Belgium, France, Germany, the Republic of Ireland, Luxembourg, the Netherlands, Spain and Switzerland.

Computer-assisted learning programs
There are four optional computer-assisted learning programs in chemistry – CALCHEM – that you can buy on disk. They are concerned with organic nomenclature, organic reaction mechanisms, retrosynthetic analysis and organic synthesis.

You will need

Colour television
Video cassette player (VHS)
Audio cassette player
Some cheap and easily obtainable items for your experiments. They are listed in a booklet that comes with the kit.
If you want to use the CALCHEM programs you will need the use of a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Books (optional)
This course has no set textbook, but if you would like to buy books for additional information or for an alternative approach, or to consult them in your local library, you could choose from:

K. P. C. Vollhardt and N. E. Schore (1994) *Organic Chemistry*, 2nd edition, W. H. Freeman
P. Sykes (1986) *A Guidebook to Mechanism in Organic Chemistry*, Longman.
J. McMurry (1992) *Organic Chemistry*, 3rd edition, Brooks/Cole (this is the set book for S344)

Residential school

This course shares a one-week summer school with S247 *Inorganic chemistry: concepts and case studies*. There is laboratory work during the day and tutorials in the evenings. The fee for the school (£199 in 1996) is not included in the course fee.

Revision weekend
A weekend revision school for this and other chemistry courses is usually held shortly before the examination. This is not formally part of the course and a fee is charged for attendance. For more information please write to the S246 Course Manager, Science Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA.

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score' calculated as a weighted average of all your scores for the course. In S246 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated S, which means that it can weight your degree towards a BSc.

Related courses
Because the subject matter of S246 overlaps with the discontinued course S24_, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. It is a requirement for an Open University degree that is recognized by the Royal Society of Chemistry. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre. If you intend to seek recognition but are also claiming transferred credit for an HNC/HND (or the equivalent) in chemistry, you are advised to discuss your plans with Dr. R. R. Hill, Chemistry Department, Science Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA, before you register for the course.

INORGANIC CHEMISTRY: CONCEPTS AND CASE STUDIES

This is a 30-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course introduces current ideas in inorganic chemistry: ideas that are not only required by those who have a direct interest in chemistry, but are also a basis for the study of several other courses. For example, a working knowledge of elementary thermodynamics is essential for the study of energy changes in biological systems, and the nature of the interaction of such elements as silicon and oxygen is at the heart of geology and geochemistry. The course includes four case studies that ask how chemistry impinges on topics of social and scientific interest.

The course is arranged in seven blocks of work. (The transition metals are not discussed in detail; the chemistry of those metals is included in S343 *Inorganic chemistry*.)

Block 1 opens with the structure and reactions of metals. The industrial extraction of mercury, tin and aluminium is discussed, and the possibility of grading metals according to their 'reactivity' is explored. This idea is also examined quantitatively using thermodynamic concepts. Enthalpy, entropy and Gibbs free energy are discussed, and the block ends with a look at Born-Haber cycles.

Block 2 covers the solid state. The concepts of lattices and unit cells are introduced and related to simple crystalline structures. Metal structures are discussed in terms of close packing of spheres, and this is then extended to show how simple ionic structures can be built up from close-packed structures by occupation of octahedral and tetrahedral holes. This part of the block is supplemented by extensive model-building exercises. Considerations of ionic radii lead into a description of radius ratios and how they can affect the crystal structure adopted by a simple AB or AB_2 ionic salt. A simple coulombic model for calculating lattice energies is used, and calculated values compared with those obtained from the Born–Haber cycle.

Block 3 begins the systematic descriptive chemistry of the typical elements. It opens with a brief introduction to the periodic table, and moves on to discuss groups I and II and alkaline earth metals.

Block 4 introduces the concept of symmetry and its application to bonding. The block starts with a treatment of valence shell electron pair repulsion theory for determining the shapes of simple molecules. This is followed by a description of symmetry elements, and the symmetry classification of simple molecules.

Electron waves and atomic orbitals are discussed before the idea of molecular orbitals is introduced for diatomic molecules. The combination of atomic orbitals to produce molecular orbitals in a polyatomic molecule is examined from the point of view of symmetry. *Block 5* starts with oxidation states, acids and bases and goes on to discuss hydrogen, the halogens and the noble gases.
Block 6 looks at rotational spectroscopy, before using the symmetry concepts developed in Block 4 to study vibrational spectroscopy. Infrared and Raman techniques are used to establish the shapes of simple inorganic molecules. A section on group frequencies is included.
Block 7 deals with the chemistry of group III, IV, V and VI elements. It applies the principles taught in earlier blocks to the chemistry of these elements, and finishes with a discussion of periodic trends.

The case studies
The four case studies look at topics of current scientific or social importance, using principles learnt in the course.
Case study 1 Hydrogen is an efficient, pollution-free fuel, but how can it be generated economically? The thermochemical generation of hydrogen is considered by applying the thermodynamic ideas introduced in Block 1.
Case study 2 Solar energy can be converted directly into electricity by photovoltaic cells. The use of semiconductors in standard photovoltaic cells and in novel semiconductor-electrolyte cells is considered.
Case study 3 Outer space contains enormous clouds of gas; this case study looks at the role of rotational spectroscopy in investigating the molecules in these clouds.
Case study 4 covers acid rain and the role of sulphur emissions in lake acidification.

Advice to applicants

You are advised to take the science foundation course, S102, before embarking on S247. If you have not taken S102 (or one of the earlier foundation courses S100 and S101) you should make sure that your knowledge of chemistry is adequate. You can get an idea of the level required by looking at the chemistry section of S102 (Units 11–18). Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you would like to do some background reading, several good introductory general chemistry textbooks are available. The following are very readable:

P. W. Atkins, J. A. Beran *General Chemistry*, 2nd edition 1992, Scientific American

J. C. Kotz, K. F. Purcell (1987) *Chemistry and Chemistry Reactivity*, Saunders

If you are disabled

Although there is a fair amount of experimental work to be carried out at home and at the residential school, you should not be deterred from taking this course. Printed material is available on audio cassette, and there are transcripts of the course cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts
Four case studies
Notes to accompany the video programmes
Notes to accompany the audio cassettes

Broadcasts and cassettes
Two video cassettes
Two audio cassettes

Home kit
Chemistry, like most science subjects, requires practical work with experiments and experimental technique. A home kit sent to you early in the course gives you experience of this. It contains apparatus and chemicals for carrying out simple but instructive experiments on metals and non-metals, and two models kits to help you to picture the sub-units of solid structure and the shape of molecules.

Outside the UK
Because of restrictions on the kit, you can take this course only in Austria, Belgium, France, Germany, Republic of Ireland, Luxembourg, Netherlands, Spain or Switzerland.

You will need

Video cassette player (VHS)
Audio cassette player

Residential school

The one-week summer school is shared with S246 *Organic chemistry* (if you take both courses, you need attend the school only once). Most of each day will be spent in laboratories. You will work on three experiments, the first based on reactions and compounds of urea, the second on the halogens, and the third on group IV elements. Evenings will be occupied by a choice of films, tutorials or problem-solving sessions. The fee for the residential school (£199 in 1996) is not included in the course fee.

Revision weekend
A revision weekend for this and other chemistry courses is usually held shortly before the examination. This is not formally part of the course and a fee is charged for attendance. For more information please write to the Chemistry Department Secretary, Science Faculty, The Open University, Walton Hall, Milton Keynes MK6 7AA.

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S247 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S247 overlaps with the discontinued course S25-, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Royal Society of Chemistry. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

S267

HOW THE EARTH WORKS: THE EARTH'S INTERIOR

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

Have you ever stopped to consider how we know that the Earth has an inner core made of an iron-nickel alloy, or why earthquakes occur when and where they do, or how parts of the Earth's crust manage to move in relation to each other? Our present understanding of the Earth's interior and the way its behaviour affects the surface draws on evidence from many areas of science, from the astrophysical to the geochemical. With the minimum of technical complexity and mathematical rigour, this Earth science course offers glimpses into the physical and chemical workings of our planet.
We have taken trouble to ensure that most of the terms and concepts you will meet are defined and developed in the study texts, and the texts include many self-assessment questions with which you can monitor your progress and understanding.
The main aim of the course is to develop a model of how the Earth works and how processes in its interior affect large-scale processes at the surface. This is achieved principally by using geophysical and geochemical techniques that reveal the main structural subdivisions of the Earth, their composition and evolution. The course takes evidence from a wide variety of sources such as studies of earthquakes, gravity, the planets, and samples of extra-terrestrial material including meteorites.
There are five study texts. *The physical and chemical properties of the Earth* gives a general introduction to deep Earth studies. It then discusses the origin of the Earth as part of the solar system and the universe, the internal structure of the Earth as deduced by seismic and gravity methods, and the physical and chemical characteristics of the Earth's interior. *How plate tectonics works* deals with large-scale processes such as plate tectonics, seismicity, faulting and deformation. It explains how the phenomena are produced by processes occurring in the Earth's interior. *Melting the mantle* investigates volcanic lavas and the roots of volcanoes within the Earth's mantle in order to learn about processes in the Earth's interior. *Evolution of the continental crust* is a continuation of the third text, explaining in particular how the continental crust formed as a result of interior and near-surface processes. *Planetary evolution* looks at the dynamic Earth, considering aspects of how the planet evolved to its present state and comparing them with the state and evolution of other bodies in the solar system.

Advice to applicants

You should be familiar with simple mathematical equations and drawing graphs. S102 *A science foundation course* would put you in a good position to start the course; your Regional Centre will be able to tell you where you can see reference copies of it, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. Units 5 and 6, 7 and 8, Unit 27 and Sections 4, 7 and 8 of Units 28/29 are particularly relevant to S267.

Preparatory work

The following textbooks contain useful preparatory material, although at quite a high level:

Geophysical topics
B. A. Bolt (1988) *Earthquakes*, W.H. Freeman, especially chapters 1–8
C. M. R. Fowler (1990) *The Solid Earth: an Introduction to Global Geophysics*, Cambridge University Press, especially chapters 4–5, 7–9
B. A. Bolt (1982) *Inside the Earth*, W.H. Freeman, especially chapters 1–4 and 7

Plate tectonics
P. Kearey, F. J. Vine (1990) *Global Tectonics*, Blackwell Scientific

Geochemical topics
D. G. Smith (ed.) (1982) *The Cambridge Encyclopaedia of Earth Sciences*, Cambridge University Press, especially chapters 4, 5, 12–14

Planetary studies
J. K. Beatty, A. Chaikin (eds.) (1990) *The New Solar System*, Cambridge University Press, especially chapters 4–7 and 12–15
D. A. Rothery (1992) *Satellites of the Outer Planets*, Clarendon Press, Oxford, especially chapters 2 and 4–7

Lists of optional reading are provided in the study texts.

If you are disabled

If you have a serious visual disability you might find some of the work with the home experiment kit or the audio-visual activities demanding. If you have restricted manual dexterity you might have some trouble with the experiment kit. There is no rigorous outdoor fieldwork. Recordings of printed course materials and transcripts of the video and audio programmes are available. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Introduction and study guide
Five study texts
Notes to accompany the cassettes
Maps

Home kit
The home experiment kit includes nine rock specimens and three phase models.

Cassettes
Seven video programmes
Three audio cassettes

You will need

Television
Audio cassette player
Video cassette player (VHS)

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S267 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S267 overlaps with the discontinued course S237, you can count only one of the two towards a BA or BSc.

Vocational qualifications
This course can contribute to the award of a National or Scottish Vocational Qualification. We will send you more information if you register for the course.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*

You can get these from your Regional Centre.

S237

PHYSICAL RESOURCES AND ENVIRONMENT

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

What do cars, concrete, and central heating systems have in common? They all use physical resources found in or on the Earth. The distribution and availability of these materials have helped to shape history, and still influence human development. These resources are very unevenly spread, and the ways and means of finding and extracting them are largely controlled by the geological setting in which

they are found. The course shows many of the principles of these geological controls, and discusses some of the environmental implications of extracting and using resources at the present rate. A global view of these implications is presented in the set book.

The course begins by looking at our use of physical resources in everyday life, then introduces their basic geology, chemistry and economics. The next book looks at *building materials*, from sand and cement to building stones, and the supply of bulk aggregates. The third book is about *water* resources, contrasting the water-rich United Kingdom with dry areas elsewhere. The fourth book deals with *energy* resources, both fossil fuels and renewable sources, and the fifth looks at the supply and use of *metals* as essential resources in modern society. The course ends by looking at wider aspects of exploitation of resources and of the environment. This part of the course is in a loose-leaf file that contains topical material and data sheets that change from year to year. The set book also covers wider environmental issues and is mostly read in parallel with the study texts. Most of the video programmes are filmed on location, about half of them abroad. They illustrate the concepts presented in the text and link many of the strands of the course with case studies. Audio cassettes help to explain and illustrate the topics in the text.

Your tutorial support may include practical sessions or a visit to local sites of resource extraction (quarries, opencast or underground mines and reservoirs).

Advice to applicants

This course is suitable for everyone who is interested in resources and has a basic science background. Many of the resources discussed have a bearing on everyday life, so it is an appropriate course for professionals who have interests in aspects of applied geology, resource management, land reclamation, or environmental and pollution control. It would be an advantage to have taken either U206 *Environment* or the technology foundation course (T102) or, especially, the science foundation course (S102) before starting this course. If you want to take a basic geology course alongside S268 we recommend S236 *Geology*. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

There is little practical work, so if you have restricted mobility or manual dexterity you should be able to cope with all parts of the course. It depends more heavily than most courses on complex figures and colour plates and the text would often be of little use on its own, so it may not be suitable if you have a severe visual disability; there are no recordings of printed course materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts
Introduction and course guide
Study guides
Glossary
Colour booklet
Geological map booklet
Data booklet
Other booklets and leaflets on resources

Broadcasts and cassettes
Eighteen video programmes
Three audio cassettes

Home kit
You will receive eight samples of rock to use with the book on building materials. They will give you a clearer understanding of some of the geology explained in the text, and you will be asked to carry out simple experiments with them.

You will need to buy

Set book
A. Gore (1992) *Earth in the Balance*. Earthscan Publications Ltd, £14.95
(1996 price)

You will also need

Video cassette player (VHS)
Audio cassette player
Scientific calculator

Assessment

There are four tutor marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S268 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

It is also part of the University's Diploma in Pollution Control.

Related courses
Because the subject-matter of S268 overlaps with the discontinued course S238, you can count only one of the two towards a BA, a BSc or a diploma.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
You can get these from your Regional Centre.

S269

EARTH AND LIFE

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This innovative Earth science course gives a fresh insight into the discipline, and opens the way into related courses. Traditional Earth science courses have taken a reductionist approach, examining individual components of the broader Earth system. *Earth and life* takes a 'top-down' approach, emphasizing the interactions between lithosphere, hydrosphere, biosphere and atmosphere. Rather than follow the geologists' conventional approach of documenting organic evolution through the fossil record, it looks at the *co-evolution* of the Earth and life: how life has evolved in response to its environment, and how by doing so it has changed that environment. The course will enable you to see current environmental debates from an informed geological point of view, and to form your *own* opinions on these complex issues. Part of the course, for example, is about the role that life has played in modifying atmospheric composition and surface temperature over the last three billion years. Current concerns about global climatic change take on a different complexion when seen from this broader perspective.

The course is divided into five blocks of work. *Origin* examines the origin of the Earth and of life itself, and the unique 'window of opportunity' that permitted life to flourish on our planet.

Earth and its climate shows that essentially 'geological' processes such as the elevation of the Tibet plateau have global climatic implications. *Atmosphere, Earth and life* traces the history of the atmosphere and investigates how the oxygen content has been stabilized at about twenty per cent for 300 million years.

Life's pyramids looks at the role of organic evolution, and the causes and consequences of global 'ice houses' and 'greenhouses'.

Man and Earth considers the effects of Quaternary climatic change, and how the evolution of early man may have been influenced by rapid climatic changes.

The course also develops your numerical and graphical skills, so that you will be able to reach significant conclusions about the Earth system from back-of-the-envelope estimates. You will also be better placed to evaluate the quality of statements in the media about environmental issues. Your communication skills will also be improved through structured exercises.

Advice to applicants

The course assumes that you have basic scientific and mathematical skills and concepts, at a level equivalent to the Open University's science foundation course (S102). If you have recently completed that successfully, you will be well placed to start *Earth and life*. If you took the foundation course some years ago and have not taken any science courses since, we strongly advise you to revise your course material. If you have not taken the science foundation course your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

This course has no practical work and no residential school, so if you have restricted mobility or manual dexterity you should be able to cope with all parts of it. If you have a visual disability, you will find this course broadly similar to other courses that rely on printed texts, figures and diagrams. There are no recordings of printed course materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five study texts

Broadcasts and cassettes
Five broadcast television programmes
Six video programmes (the five broadcast programmes will also be available on cassette)
Two audio cassettes

You will need

Television
Video cassette player (VHS)
Audio cassette player

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S269 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Vocational qualifications
This course can contribute to the award of a National or Scottish Vocational Qualification. We will send you more information if you register for the course.

S282

DISCOVERING PHYSICS

This is a 30-point course at Level 2, with a one-week residential school. It requires no computing equipment.

The course

This course gives a broad survey of physics at an introductory level. The material is structured in such a way as to allow you to discover many of the principles for yourself, through guided exercises and experiment, and to consolidate your understanding of these principles by using them repeatedly. The course covers many fundamental concepts and will enable you to understand a good variety of physical phenomena and the operating principles of everyday devices. It also gives an introduction to scientific methods and allows you to acquire and practise the skills of basic mathematical modelling and scientific problem-solving.

The course is divided into three main parts. The first two (eleven sections) are concerned with what is usually termed classical physics, although it is still very much used by physicists. The third part (five sections) discusses important discoveries of twentieth-century physics. The sections are:

Motion in one dimension In order to explain how things move and to predict future changes in their motion we need a simple but precise way of describing motion. We begin by introducing Newton's laws of motion and the calculus notation in which he formulated them.

Motion in two and three dimensions We continue to develop the language of dynamics through vector notation, which allows us to describe such things as the path of a golf ball, the orbital motion of the Earth round the sun or the route of a plane blown off course by a side-wind.

Conservation of momentum and energy The concepts of momentum and energy, together with an understanding of what physicists mean by conserved quantities, allow us to solve problems involving more complex types of motion or the collision of several objects.

Rotational motion Here we turn our attention from motion arising from simple pushes or pulls to the dynamics of objects that have been subjected to twists and turns.

Kinetic theory and chaos The link between the macroscopic and the microscopic world is made by considering the apparently random motion of the molecules in a gas. We also explore some of the implications of the relatively new branch of science known as chaos. There is material at the end of this section to help you to revise and consolidate the concepts and skills you have used in the course so far.

Vibrations The vibration of a violin string and that of a car suspension have much in common. We introduce the mathematical description that covers both, and discuss the phenomenon of resonance, which is essential to many musical instruments, and damping, without which shock absorbers would not work.

Waves The fact that light propagates like a wave explains the colours of many iridescent beetles and butterflies. We also examine the differences in nature between sound waves and light waves.

Charges, forces and fields The often hidden electrostatic force is responsible for the structure of atoms and solids. The key idea of a field is introduced.

Electric potential and electric current You will examine the behaviour of simple electric circuits both in a theoretical way and by doing some experiments.

Magnetic fields and the Lorentz force law Currents, or any kind of moving charge, give rise to another type of field, the magnetic field. You will see how this field operates in a wide variety of situations, from particle accelerators to interplanetary space.

Electric and magnetic fields that vary with time A discussion of the currents induced by changing fields culminates in an account of one of the greatest achievements of classical physics: Maxwell's equations and their prediction of electromagnetic radiation. More help with

revision and consolidation is given at the end of this section.

Special relativity Special relativity has acquired an almost mystical reputation because its predictions are at such variance with our preconceived ideas of space and time. We show how these predictions, which have been verified many times, are the natural consequences of the simple postulates made by Einstein.

The beginnings of modern atomic physics Classical views of matter cannot explain phenomena such as line spectra or the emission of electrons from metals. We trace the historical debate that led to the realization that light can behave as if made of particles and to Bohr's quantum model of the atom.

The quantum mechanical theory of matter Here you will discover how quantum mechanics has been refined into a consistent and accurate theory of the microscopic (and macroscopic) world. It does this by treating material particles as a type of wave and makes some strange predictions, including the statement that some apparently simple measurements are inherently imprecise.

Quantum mechanics in atoms We show how quantum mechanical ideas explain the spectra emitted by atoms and the periodic table of the elements.

Applications of quantum mechanics This section provides a survey of the last part of the course, bringing together relativity and quantum mechanics and showing how quantum mechanical principles are manifested in a wide variety of phenomena such as superconductivity, the operation of lasers and stellar evolution.

Advice to applicants

Students with a wide range of backgrounds choose this course, and for very different reasons. Some just want to satisfy their curiosity about the physical world, perhaps to improve their understanding of current scientific and technological debates. At the other end of the range are those who are already engaged in other areas of science and want to consolidate their grasp of physical principles.

This is an introductory course and little knowledge of physics is assumed. You will need some basic scientific and mathematical skills: interpretation of graphs, manipulation of simple algebraic equations and an understanding of elementary geometry and trigonometry. Other mathematical techniques, including use of vector notation and some calculus, are taught in the course. We have tried to keep the mathematical content to the minimum, but that minimum is quite significant. The language of physics is mathematics and if the mathematics poses a severe problem for you, you will find it impossible to understand the physics concepts. A maths diagnostic quiz, available from the course manager (tel. 01908 652278), will give you an idea of the level of maths we assume at the start of the course.

Preparatory work

If you have no background in the physical sciences or mathematics you may find the course difficult. A useful preparation for the science would be to read the Open University's science foundation course (S102), particularly Units 2, 3, 9, 10, 30 and 31. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

If you have difficulties with manual dexterity you should be able to achieve most of the course objectives, except for a few particularly associated with practical work. If your appreciation of complex diagrams is likely to be severely limited you will be at a serious disadvantage. There are recordings of printed course materials and transcripts of broadcasts and course cassettes. The course manager, telephone 01908 652278, will be pleased to offer more information and to answer questions. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts

Broadcasts and cassettes
Four television programmes
Three video cassettes
Five audio cassettes

Home kit
You will be lent a small experiment kit containing simple electrical and mechanical apparatus. The texts give instructions in the use of the apparatus, and the teaching in the appropriate sections depends on your carrying out the experiments described there.

You will need

Television
Video cassette player (VHS)
Audio cassette player
Calculator

Residential school

The one-week summer school is held at Durham University. The emphasis is on laboratory work but there will also be tutorials, example classes, lectures, films and computer-based activities. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It can count towards full membership of the Institute of Physics; it is also one of the courses approved for the Merchant Navy Extra Master's Certificate. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporations*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

S280

SCIENCE MATTERS

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

Science matters is for everyone who has an interest in the application of science and its implications in the modern world. The course examines the nature and strength of the scientific facts and opinions that underlie some well publicized topics that are influencing the present and will influence the future. By the end of the course you should be equipped with the scientific understanding and skills you need to make more informed and balanced judgements about these topics. You should also be able to apply these skills to other scientific issues of general interest.

The skills introduced and developed in the course come under the broad headings of analysis, evaluation and synthesis. They include:

- Recognizing incompleteness, variability and unreliability in scientific data.
- Assessing the quality and interpretation of scientific data.
- Distinguishing claims and arguments that are based on scientific evidence from those that are not.
- Selecting and extracting relevant information.
- Constructing logical, coherent and objective arguments.

Your competence in study skills such as effective reading and writing will also be increased, largely through use of the set book.

The course is divided into seven books, each concentrating on important aspects of scientific understanding while also looking at social, political and ethical implications.

The first book, *The rise and fall of leaded petrol*, introduces the aims and philosophy of the course, discussing how it complements courses that stress more theoretical aspects of science. This course emphasizes the way science impinges upon the world in which we live, a point immediately illustrated by a case study on the scientific and social issues to do with the use of lead in petrol.

Agriculture looks at some of the ways science bears upon selected aspects of agriculture (including the spread of oilseed rape, the use of pesticides, animal production systems, BSE ('mad cow disease'), nitrate pollution and sustainable agriculture).

Nuclear power begins by presenting the scientific background to all aspects of nuclear power production, then considers the issues that arise from its use, including the risks, the economics, disposal of radioactive waste and proliferation of nuclear weapons.

In *Genetic engineering* we consider the techniques that are now available to manipulate the genetic material of living organisms directly, and their use in medicine and in animal and plant breeding. What opportunities and threats does genetic engineering present?

Changing climate is about the central question of global warming and climate change. Why is there so much controversy and uncertainty about future climate change? Can we turn to science for an answer?

The course ends by offering an opportunity to apply some of the key scientific skills in the context of two short case studies that look at the development of scientific ideas.

Insulin: discovery and development looks at the controversial events surrounding the discovery of insulin, at how this important hormone is used nowadays to control diabetes, and at what medical innovations may lie ahead.

The deep sea constitutes the largest environment on the planet, yet we still know very little about it. In *Discovering the deep oceans* we look at some of the revolutions in thought that had to occur before we could even begin to understand how the oceans work.

Four television programmes draw out themes that are common to many of the course topics by seeing what happens when science leaves the laboratory and interacts with the 'real world'. Two radio programmes, broadcast towards the end of the course, are related to developments that have taken place since the course texts were printed. The audio cassettes are used in conjunction with printed material to reinforce the development of skills, to deal with techniques that are relevant to more than one book and to consider aspects of science and the media.

Advice to applicants

This is an interdisciplinary course that is designed to reinforce the theoretical content of the Open University's science foundation course and apply it to broader scientific matters. Basic scientific literacy is therefore assumed in the four disciplines of physics, chemistry, biology and Earth sciences. You are expected to be familiar with terms such as energy, mass, element, atom, electron, gene, chromosome, radioactivity, rocks, minerals. Nevertheless, the key scientific concepts you need to understand the course topics are usually briefly revised in the text.

The emphasis on the development of skills through structured activities should make this course more accessible if you have not done any study for some time, but the standard of work is still appropriate to Level 2.

Preparatory work

We strongly recommend that you make yourself familiar with the set book before the course begins. You will also find it helpful to read the science pages of daily newspapers and to look occasionally at your local library at 'popular' science magazines such as *New Scientist* and *Scientific American*.

If you are disabled

Since there are no experiments to be carried out at home and no residential school, this course is a good choice. There are recordings of the printed material and transcripts of the broadcasts and audio cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts
Study guides
Collections of offprints
Notes to accompany television and radio programmes and audio cassettes

Broadcasts and cassettes
Four television programmes
Two radio programmes
Three audio cassettes

You will also need

Set book
A. Northledge *The Good Study Guide*. 2nd edition. The Open University, £6.99 (1996 price)

You will also need

Scientific calculator
Television
Radio
Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly on an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S280 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

It can also count towards the University's Diploma in Pollution Control.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflet:

3.5 *Membership of professional bodies: Institute of Wastes Management*

You can get this from your Regional Centre.

S281

ASTRONOMY AND PLANETARY SCIENCE

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

Where did the universe come from? How will it end? How are the stars born? How rare are planetary systems? Why aren't all planets like the Earth? These are some of the big questions that this introductory course tackles. We describe the universe as we see it today, from the Earth to the most distant galaxies. We consider the birth, life and death of stars and planets, and we discuss how the universe began, how it has evolved on all scales, and how it might continue to evolve into the distant future. We describe our local

view of the universe, and there is project work based on simple observations of the sky. The course is arranged in four blocks.

The stars and the interstellar medium
Observations of the sun and other stars. Stellar interiors. The birth of stars in interstellar clouds. The life and death of stars, including red giants and white dwarfs, supernovae, neutron stars, pulsars and black holes. The evolution of the interstellar medium.

Project work is largely observational and most of it takes place alongside your study of the stars and the interstellar medium. You need no experience, and it is possible to make the observations from an urban site. Binoculars are needed for some of the projects (any sort will do), but photographs can be supplied if you have none or if you cannot make observations for any other reason.

The planets Outline of the solar system. Origin and evolution of planetary bodies. Planetary processes exemplified by cratering, volcanism, atmospheric chemistry, atmospheric circulation. Physics and chemistry of the giant planets. Evidence from meteorite studies.

Galaxies How the architecture of our galaxy and the distances to the other galaxies have been established. The main features of the cosmic menagerie of galaxies, and the variety of processes that occur in them. Clusters of galaxies, and dark matter. The large-scale distribution of galaxies.

The origin and evolution of the universe
Observational evidence about the origin and large-scale evolution of the universe. The 'hot big bang' theory of the origin. 'Missing' matter, and the large-scale evolution of the universe. Instruments and observational techniques are covered mainly in the television programmes, and we hope to arrange optional visits to observatories, museums and planetaria.

Advice to applicants

The course is suitable for all those who want to develop their understanding of astronomy, including amateur astronomers and school teachers (at all levels) who would like to include astronomy in their teaching. Because it is intended for a wide range of people the amount of mathematics is modest, extending only to simple algebra and graphs, but the powers of ten are freely used, and so are graphs to show the relationship between the values of two quantities. Angles are measured in both degrees and radians, and the sine and cosine of an angle occur in the texts in several places. Several algebraic equations are used, but you have to manipulate only a handful of fairly simple equations. You must be able to put values into algebraic equations to obtain a result, but we give you practice in solving such problems. You do not have to remember equations and the values of physical constants, as they will be given in the examination paper.

You are not expected to have any knowledge of astronomy, but we advise you not to attempt this course unless you have a little knowledge of mathematics or physics. You should have *either* an O level pass *or* a GCSE at level B or above *or* an equivalent qualification in *both* those subjects. You are advised to take the science foundation course (S102) first, though the technology or mathematics foundation course would do instead. If you are particularly concerned about the level of either mathematics or physics the course will require, please write to the S281 Course Manager, Department of Physics, The Open University, Walton Hall, Milton Keynes, MK6 7AA and ask for the *Preparatory Science* booklet before you commit yourself to taking the course. (Please enclose an A4 stamped addressed envelope.)

Preparatory work

The only preparatory work that we advise you to do is to study the *Preparatory Science* booklet that you will receive if you register for the course (or earlier if you ask for it – see *Advice to applicants*). This should take about five hours.

If you are disabled

If you have a severe visual disability you may not be able to make full use of the television programmes, the video cassette and the (optional) visits, or to complete most of the project work. There are recordings of printed course material and transcripts of some of the audio-visual material. Please ask for information and advice from the S281 Course Manager, Science Faculty, The Open University, Walton Hall, Milton Keynes MK6 7AA; and ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course material

Printed materials
Six study texts
Book of colour illustrations

Broadcasts and cassettes
Eight television programmes
Two video cassettes
One audio cassette

You will need

Television, video cassette player (VHS), audio cassette player
Calculator
Binoculars (though you could manage without)

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S281 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S281 overlaps with parts of the discontinued course S256, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the Institute of Physics. You can find out more from our Recognition Information leaflet:
3.8 *Membership of professional bodies: scientific institutions*
You can get this from your Regional Centre.

BIOLOGY: BRAIN AND BEHAVIOUR

This is a 60-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course is designed to:
- Present an integrated, interdisciplinary approach to the brain and behavioural sciences and to the relationships between them.
- Provide you with a core of basic knowledge about animal behaviour and neurobiology that will equip you to go on to a detailed interdisciplinary study of important topics in these areas.
- Enable you to compare the behaviour and nervous systems of human beings and other animals and, at the same time, understand the attributes associated uniquely with a complex nervous system.
- Make you familiar with observational and experimental methods in the brain and behavioural sciences, and introduce experimental design and analysis.
- Consider the implications for human health of the knowledge we have of behaviour and the nervous system, and show you how the study of disease has helped in the study of normal physiology.
- Familiarize you with the conceptual and social context of the study of the brain and behavioural sciences.

The course is divided into six books of different lengths. Books 1 and 2 give basic information about the behavioural and brain sciences respectively, then four books cover a series of topics, each explored in an interdisciplinary way that brings together knowledge from animal behaviour, psychology and neurobiology.

Book 1 *Behaviour and evolution* is an introduction to animal behaviour and evolution. It looks at the causes of behaviour and its genetic basis; evolution, natural selection and the adaptiveness of behaviour; the development of behaviour; learning; motivation; animal cognition; reproductive behaviour, and the behaviour of animals that live in groups.

Book 2 *Neurobiology* examines the anatomy and function of the brain and nervous system; the links between the nervous system and hormones; the regulation and control of the nervous system; the fine structure and function of the nerve cell; generating and transmitting signals in the nervous system; the senses; and the control of the muscles of the body by the nervous system.

Book 3 *The senses and communication* investigates hearing, vision, touch and pain, and their role in language and in animal communication in general.

Book 4 *Development and flexibility* is about development and flexibility in the nervous system and in behaviour, including the role of learning and memory.

Book 5 *The control of behaviour* considers motivation, sleep, biological rhythms, aggression and stress.

Book 6 *Degeneration, damage and disorder* asks what happens when things seem to be going wrong. It discusses the effects on the nervous system and on behaviour of brain damage, disorder, degeneration and disease and of ageing. It describes changes in approach to mental illness and how finding out what happens when the system goes wrong has helped our understanding of normal functioning.

Advice to applicants

It would be very helpful to have a scientific background, but it is not indispensable since the course is designed to be accessible without. We hope that it will be equally interesting to biologists and to those who have no biological or scientific knowledge at all. The University's science foundation course (S102) or social science foundation course (D103) would put you in a good position to begin the course.

If you are disabled

Printed course material is available on audio cassette, and there are transcripts of the broadcasts and course cassettes. The course includes practical work – experiments to be carried out at home and at the residential school – and there is extensive use of monitor screens to display data at the school; this may be a problem for anyone who has epilepsy. Difficulties can usually be accommodated, however, especially since students often work in groups at the school, and everyone is encouraged to attend it and to attempt the experiments. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six study texts
Introduction and guide to the course
Video and broadcast notes
Guide to designing experiments in the behavioural sciences
Experiment notes
Information sources in the brain and behavioural sciences
Glossary
Index

Broadcasts and cassettes
Eight television programmes
Three video cassettes
Six audio cassettes

Home kit
The home kit contains 'Brian', a plastic model of a human half-brain that can be dismantled into four parts to show the internal structure of the brain. After studying the *Guide to designing experiments in the behavioural sciences*, you carry out two experiments following instructions in the *Experiment notes*. You should also design an experiment yourself to investigate a given hypothesis and submit your design as part of the set work. After the residential school, with your tutor's comments and the extra experience of experimental design gained at the school to help you, you carry out a trial run of your experiment and write up your final design as a project.

You will need

Television
Video cassette player (VHS)
Audio cassette player
Some simple, inexpensive equipment such as a pair of dividers and a ruler

Residential school

The one-week summer school includes experimental work, lectures and seminars. The experimental work is divided into neurophysiology, perception and animal behaviour. None of it requires you to take part in dissections or invasive experiments. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are eight tutor-marked assignments, one computer-marked assignment and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In SD206 this rule can apply to two tutor-marked assignments, but not to the project. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course is recognized by the British Psychological Society as one of the set of courses making up an Open University honours degree that can confer eligibility for Graduate Basis for Registration at the Society. The course can also count towards membership of the Institute of Biology and the Chartered Institution of Water and Environmental Management. You can find out more in our Recognition Information leaflets:
3.1 *Membership of professional bodies: the British Psychological Society*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

For the future

SD206 will be presented for the last time in 2000.

HUMAN BIOLOGY AND HEALTH

This is a 30-point course at Level 2.
It has no residential school and requires no computing equipment.

The course

This course presents human biology in a way that is directly connected with health and healing. It will appeal to students from a variety of backgrounds, in science, technology, the humanities or the paramedical professions. The

course is jointly produced by the Science Faculty and the School of Health and Social Welfare
The course uses the human life span to explain how the body grows, develops and matures into a healthy individual. It looks at human beings in a social, cultural and environmental context since all individuals are part of a larger whole, it also considers their place in society and in the global environment. It takes a developmental and holistic approach and presents the biological foundations of health as a dynamic process. The principles of generation and regeneration are shown as a basis of healing.
The central and most extensive section of the course is concerned with an integrated study of human biology, drawing on the disciplines of anatomy, physiology, immunology, biochemistry, endocrinology and genetics. This study includes all the biological facts and figures to be found in traditional courses in human biology, but they are presented as part of a functional and developmental account that is radically different from the usual format, which rarely assembles the 'parts' into an integral human being.
The course is presented in six books, each accompanied by a study guide that links the text with television programmes and video and audio cassettes.

Health and development: conception to birth
Concepts of health and biology; life process and way of life; early development; the developing embryo; foetal development and birth.

Growing and responding
Body organization and growth (musculo-skeletal system); communication and control (nervous and endocrine systems). Responding to non-self: the immune system.

Maintaining the whole
Digestion, metabolism and thermoregulation; fluid regulation and excretion; feeding and drinking; diet and health.

Activity and health
Circulation and respiration; movement; exercise; sleep.

The human condition
Gender and reproductive processes; human sexuality; pain, stress and a 'stress-free' life; states of awareness.

Living and dying on a shared Earth
Ageing population; biology of death; populations and human relationships; the human genome project.

Advice to applicants

As well as its value to science students who have an interest in biology and health, the course also offers an introduction to human biology for those in arts and social sciences. It is also very appropriate for health and social care workers and particularly for people in professions allied to medicine.
The course assumes little more than a general awareness of and enthusiasm for human biology. Case studies are used to link the course material to experience, and this should be of special interest to nurses and other paramedical professionals who often have to relate their education to clinical practice. It could serve as a refresher course for nurses returning to work and for anyone who wants to keep up to date. Credit for this course might also help you in your career.

If you are disabled

The course should not present any undue difficulties. We hope that the printed material will be available on audio cassette after 1997, the course's first year. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six books with associated study texts
Notes to accompany the broadcasts, video and audio cassettes
Offprint collection

Broadcasts and cassettes
Five television programmes
Three video cassettes
Three audio cassettes

You will need

Television
Video cassette player (VHS)
Audio cassette player

Assessment

There are four tutor marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It can also count towards the University's Diploma in Health and Social Welfare. If you would like to know more about this please ask your Regional Centre for the *Health and Social Welfare* brochure.

S104
OUR CHEMICAL ENVIRONMENT

This is a 30-point course at Level 2, with a half-week residential school.
It requires no computing equipment.

The course

This course has been designed to be accessible to students who have no background in science. Through a series of illustrations from everyday life it develops a working knowledge of what goes on at the microscopic level and how much can be explained in those terms. By the end of the course you will be able to develop informed views about such questions as how drugs are designed to have fewer side effects, why the Bronze Age preceded the Iron Age, and many others.
The course shows how microscopic structure is critical to the way things behave. A series of topics concentrates on materials, energy, food, nutrition and the quality of life, and leads to a look to the future. By the end of the course you will be able to go on to take further chemistry courses, or to follow a route to the University's Diploma in Pollution Control.

Advice to applicants

You should have the basic study skills that you would get from *any* of the Open University's foundation courses. Your Regional Centre will be able to tell you where you can see reference copies of these, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

Practical laboratory work is an important part of the residential school, but disabled students have had considerable success in chemistry-related courses. There is some experimental work to be carried out at home, and if you have a *severe* visual disability or *severe* restriction of mobility or manual dexterity you may find some things rather difficult. There are recordings of printed course materials and transcripts of television programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Four study texts
Notes to accompany audio cassettes
Glossary
Chemistry set booklet

Broadcasts and cassettes
Six television programmes
Two video cassettes
Two audio cassettes

Home kit
You will receive a non-returnable experiment kit to use at home. The experiments are an integral part of your study, so it is important that you do them at the appropriate times. Some of the work for your tutor may be based on the results from your experiments.

Outside the UK
Because of restrictions on sending the kit overseas this course is not available in Denmark, Finland, Gibraltar, Greece, Italy, Portugal or Sweden.

You will need

Colour television
Video cassette player (VHS)
Audio cassette player
Some cheap and easily obtainable items for your experiments. They are listed in the chemistry set booklet supplied with the kit.

Residential school

The half-week residential school is held during July and August. The programme consists of laboratory work, projects and tutorials. The fee for the school (£99.50 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, three computer-marked assignments (which will not count towards your course result) and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated S, which means that it can weight your degree towards a BSc.
It is also part of the University's Diploma in Pollution Control.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets, which you can get from your Regional Centre.

S281
IMAGES AND INFORMATION

This is a 30-point course at Level 2, with no residential school.
Use of a personal computer is optional.

The course

This course about the science and technology of modern imaging systems includes many exciting features. Modern imaging science embraces a vast array of techniques and devices (such as microscopes, telescopes, cameras, television sets) by means of which we can obtain and process information about the size and shape of a variety of objects, from galaxies to bacteria to single atoms. Some devices work with light, others with radio waves, X-rays, electron waves or acoustic waves. By the end of the course you should be able to:

- Describe and exemplify the ways in which man-made imaging systems increase our knowledge of the world.
- Give an account of the principles underlying the design of imaging systems.
- Describe in general terms the sort of imaging system best suited to obtaining the desired information from an object of interest.
- Use to better advantage imaging systems ranging from an ordinary camera to the more sophisticated devices found in laboratory, hospital and factory.

The course is divided into a 'stem' of study texts and a 'tail' of case studies. The stem is mainly concerned with the theoretical basis of modern imaging science, though practical applications do occur in it. Modern analysis of imaging systems is based on the so-called Fourier approach. This is conceptually tricky, but in practical terms very rewarding. The topics covered in the stem of the course are:
The 'waves and rays' approach to imaging
The Fourier explanation of diffraction
Coherent and incoherent illumination
Holographic recording of images
Lenses, images and transfer functions
Spatial filtering of images
The case studies include astronomical topics (the physics of the Crab Nebula and the Mariner 9 space probe), electron microscopy and medical imaging.
The course is being gradually revised and the new version will be ready for 1997. The content and aims of the course remain essentially unchanged but we have taken the opportunity to improve the teaching of parts that students have found difficult.

Who is it for?

This course is particularly suitable for teachers of science and allied subjects at secondary and tertiary levels, and for technical and engineering staff who are working or intend to work with imaging systems.
The course requires facility with basic mathematics, particularly trigonometry, complex logarithms and simple algebra, and with graphs. Graphs are particularly important because we have replaced the calculus and much of the algebra associated with this subject by a simpler graphical approach. Calculus is not used, for the underlying concepts are still essentially mathematical in nature and if you find basic mathematics unpalatable you may find the course hard going.

Preparatory work

If you would like to prepare for the beginning of the course, which discusses the basic ideas of wave propagation and introduces the fundamentals of geometrical (ray) optics and lenses, you could choose from the following books and 420pp University course texts:
R. E. L. Newton *Wave Physics*, Edward Arnold. This includes some topics not relevant to the course but is an excellent introductory text for the first part of it.
Akrill, Beattie, Millar *Physics*, Edward Arnold, chapters 22–25 and 25–28.
A. P. Arya *Introductory College Physics*, Collier Macmillan, chapters 17 and 28–30.
Your Regional Centre will be able to tell you where you can see reference copies of the course we suggest here, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.
S102 *A science foundation course*, Units 14 *Modelling the Behaviour of Light*
S271 *Discovering physics*, Units 5 and 7 *Vibrations and Waves*

If you are disabled

If you have impaired sight you may find this course unsuitable, and if your manual dexterity is restricted there will be difficulties unless you have a helper to assist with the practical work. Printed course materials are not available on audio cassette but there are transcripts of some of the video programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Fifteen study texts
C. A. Taylor, T. R. Wilbery *Aids to Special Purposes*, Bell and Hyman

Cassettes
Three video cassettes
Three audio cassettes

Home kit
You will be sent an experiment kit that includes a laser, a camera and an optical bench with fittings. Detailed instructions are provided, and ample time is allowed for using the kit. The home experiments are an essential part of the course, but no special experimental skills are required.

Outside the UK
Because of restrictions on sending the kit overseas this course is not available in Gibraltar. Elsewhere outside the UK the kit can be supplied but without the mains leads.

Optional computer tutorials
These are sent to you on floppy disks and can be used on any computer that meets the specification: essentially any IBM PC compatible capable of running GEM software. The tutorials provide optional revision; the course itself does not require a computer. More

information about these computer tutorials will be sent to you if you register for the course.

You will need

Television
Video cassette player (VHS)
Audio cassette player
If you want to take advantage of the computer tutorials you will need a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In ST291 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by the Royal Society of Chemistry and the Institute of Physics, and is one of the courses approved for the Merchant Navy Extra Master's Certificate. You can find out more in our Recognition Information leaflets:

1.4 Particular careers: Civil Service, armed forces, merchant navy, police and public corporations
5.3 Membership of professional bodies: the professional engineering institutions
5.7 Membership of professional bodies: Institute of Physics
5.8 Membership of professional bodies: scientific institutions

You can get these from your Regional Centre.

SD292
SCIENCE, TECHNOLOGY AND EVERYDAY LIFE 1870–1950

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This course will equip you with the basic skills you need for the study of the social history of science and technology, such as the ability to evaluate both historical evidence and theories about the development and interaction of science, technology and society. The main aim, however, is to enable you to associate changes in people's lives at home, at work and at leisure with scientific and technological developments at the heart of what has been called the 'second industrial revolution'. We explore how and why such developments came about by considering, for instance, the roles played by government policy, consumer demand, capitalist expansion and ideological debate. The processes of discovery, invention, innovation and diffusion are examined in their social context, involving you in debates about how much influence science and technology have had on historical change. You will be encouraged to examine critically the belief in scientific and technological progress that was widespread in the period covered by the course. We concentrate mainly on the United Kingdom, the USA and, to some extent, Western Europe. A study guide, which includes questions to help you to assess your understanding and notes to accompany the broadcasts and cassettes, takes you through the course.

The main text is an anthology of thematic essays. There are two introductory chapters that deal with general matters (such as the conditions of technological innovation and the relationship between 'science' and 'technology') and chapters on the following areas:
Electrification
Materials (e.g. plastics, bulk steel)
Transport (e.g. the internal combustion engine)
Communications (e.g. radio, cinema)
Food
Health and medicine
Social and human engineering (e.g. applications of 'scientific method' to human problems)
The concluding chapter, on Russia, provides a broader comparative view.
Each of the eight television programmes is closely related to an anthology essay. The first introduces the theme of contemporary beliefs in technological progress, and each of the following seven deals with a particular innovation or set of innovations, such as the electric home, aluminium, the motor car, radio and cornflakes. An audio cassette at the end of the year reviews the course and offers advice to help you to prepare for the exam.

Advice to applicants

You are not expected to have any special knowledge, and every effort has been made to make technical details as clear as possible through the written word and illustrative material.

Preparatory work

It might be helpful to read relevant sections of D. S. Landes *The Unbound Prometheus* (Cambridge University Press, 1969), and to look at the appropriate bits of S. Giedion *Mechanization Takes Command* (W. W. Norton, 1969).

If you are disabled

There is a large amount of illustrative material that has to be studied, and the broadcasts are an important part of the course. Printed course materials are available on audio cassette, and it may be possible to obtain set books on cassette from the RNIB Student Cassette Library. We will be able to offer transcripts of the television programmes and audio cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Study guide and thematic essays
Sources for the Study of Science, Technology and Everyday Life 1870–1950 Vol. 1 *A Primary Reader*

Broadcasts and cassettes
Eight television programmes
One audio cassette

You will need to buy

Set book
C. Chant (ed.) *Sources for the Study of Science, Technology and Everyday Life 1870–1950* Vol. 2 *A Secondary Reader*, Hodder and Stoughton, £10.99
(1996 price)

You will also need

Television (preferably colour)
Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In A282 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

For the future

A282 may be presented for the last time in 1998. We intend to replace it with a course in the history of technology that will not overlap to any significant extent with this course.

A282
THE RISE OF SCIENTIFIC EUROPE 1500–1800

This is a 30-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This course should be of wide interest. It tackles a fundamental question of the modern world: why did modern science develop only in Europe? And why in some parts of Europe rather than in others? It is well established that Europe experienced a scientific revolution in the seventeenth century, but why did this happen when and where it did? You will have an opportunity to investigate these questions and to examine the conditions that fostered or hindered the growth of science.
Comparison and contrast are important features of the course. There are some comparisons between Europe, China and the lands of Islam, considering what was common and what was distinctive in the prevailing conditions in these very different societies, and judging whether this led to differences in scientific development. Most of the course investigates similarities and differences among the countries of Europe.
After a broad introductory survey of Chinese science, the course concentrates on Copernicus in Poland and the spread of his challenging astronomical theory through Europe; on the conditions in Italy that stimulated Galileo's work and also led to his arrest and trial by the Inquisition; the distinctive environment of Portuguese and Spanish science at this time; the developments in the German states; the surge of French science and the explosion of English seventeenth-century science; the reasons for the spread of Newtonianism; and the Scottish enlightenment. We also look at the peripheral zones rarely discussed in this context: Sweden, Russia and the Balkans.

Advice to applicants

Technicalities are fully explained and scientific issues and discoveries are described in a way that non-scientists will be able to understand. But it is not the aim of the course to dwell on technical points. The broad historical themes are its principle concern, and so those who have an arts background will not be at a disadvantage.

If you are disabled

The course should present no special problems, although if you are visually disabled you may have some difficulties with one of the television programmes and some of the audio-visual material; both these are important parts of the course. There are recordings of the printed course materials and transcripts of the television programmes and cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
An introduction to the course
A book of sixteen chapters specially written for the course
A reader of contemporary documents
A study guide that links all the elements of the course and includes notes on the broadcasts

Broadcasts and cassettes
Eight television programmes
Two audio cassettes

You will need to buy

Set book
The Rise of Scientific Europe 1500–1800: a Secondary Source Anthology Vol. 2
At present this is available only through the Open University.

You will also need

Television
Audio cassette player

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In AS283 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It is also part of the University's Diploma in European Humanities.

Related courses

Because the subject-matter of AS283 overlaps with the discontinued course AMST283, you can count only one of the two towards a BA, a BSc or a diploma.

For the future

AS283 will be presented for the last time in 2001.

AS283
HEALTH AND DISEASE

This is a 60-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This course should appeal to anyone who has a broad professional or lay interest in some of the important issues to do with health and disease in the UK and the rest of the world today. It draws on current research in social sciences, medicine, history and biology and fosters a critical awareness of the many different approaches to health matters, from the personal subjective experience of being ill to the biological and medical view of illness and the economic and political aspects of health and disease.
Medical knowledge: doubt and certainty traces the development of scientific medicine since the sixteenth century and questions the relationship of medical knowledge to health through three case studies – tuberculosis, blood and hysteria – that illustrate the effect of society on medicine and the effect of disease on society.
Studying health and disease introduces research methods in history, biology and the social sciences. You will not be expected to become a competent user of these methods, but you should be able to understand their scope and limits. Topics include the philosophy of science, basic methods in demography and epidemiology, archives and records, qualitative interviewing, questionnaires and surveys, clinical trials and experimental design.
World health and disease describes the predominant patterns of health and disease round the world both now and in the past, looking at geographical differences as well as ethnic, gender and class variation. It then examines patterns of mortality and morbidity in the United Kingdom and how they might be explained in terms of social and economic structures. The effects of industrialization, nutrition and population growth are important themes of the book.
Human biology and health: an evolutionary approach describes the evolution of living cells and the unique aspects of human anatomy and physiology that contribute to present-day patterns of health, illness and disability. No knowledge of biology is assumed, and basic terminology and concepts are introduced carefully. Human biology is discussed in terms of genetic variation, mechanisms of ageing, adaptation to threats to health posed by

infectious organisms, and failure to adapt to threats from modern cultural evolution.
Birth to old age: health in transition traces factors that affect health from birth to old age, looking particularly at the important transitional points such as birth, adolescence, mid-life and death. Each part of the lifespan is seen from the point of view of a different discipline, with the emphasis on psychological and cultural factors as influences on health and well-being.
Caring for health: history and diversity considers the historical development of services, institutions and occupations in health-care, and wider public policies affecting health in Britain from 1500 to the present day. The book traces the interaction between European systems of health-care and indigenous healing traditions in the former colonial territories of European states. The relationship between formal and lay health care and the role of women as providers of health-care are considered. The book ends with a comparative analysis of methods of financing the provision of health-care.
Dilemmas in health care considers dilemmas in the management of the NHS: decision-making at national, local and individual levels; rationing and choice; the rise of consumerism and the health-care 'market'; evaluation of care; the influence of new technology; issues faced by health-care workers, particularly nurses; and care in the community. The scope then widens from health-care to public policy and strategies for preventing illness by alleviating poverty.
Experiencing and explaining disease relates the subjective experience of disease to the biological and social explanations that have been offered for it. There are case studies of asthma, rheumatoid arthritis, schizophrenia and AIDS, discussed in the context of debates about stigma and normality, pain and suffering. The book explores ways in which the experience of these conditions is affected by society's attitudes to them, and by the current state of medical knowledge.

Advice to applicants

You are not expected to have any special knowledge or technical competence. The course includes a basic guide to the research methods and approaches characteristic of medicine, biology and the social sciences.

Preparatory work

Any reading on health-related topics would be useful. You might like to begin reading articles from the set book, or you could try *Inequalities in Health* by Peter Townsend and Nick Davidson (Penguin).

If you are disabled

Printed course materials are available on audio cassette, and transcripts of the television programmes and course cassettes can be provided. Please ask your Regional Centre for our booklet *Meeting your Needs* if you haven't already got it.

Course materials

Printed material
Introduction and guide
Eight study texts
Notes to accompany the television programmes and audio cassettes
Notes on essay-writing
Historical supplement

Broadcasts and cassettes
Twelve television programmes
Five audio cassettes

You will need to buy

Set book
B. Davey *et al.* (eds.) *Health and Disease: a Reader*, 2nd edition 1995, Open University Press, £14.99 (1996 price)
This is a collection of previously published and specially commissioned articles on topics related to the course. Each study text offers a list of optional further reading if you have a special interest.

You will also need

Television
Audio cassette player

Assessment

There are seven tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In U205 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.
It can also count towards the University's Diploma in Health and Social Welfare.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body, and you can count it towards the qualifications of the Institute of Biology or the Institute of Hospital Engineering. It can also count towards the General Practitioners Postgraduate Education Allowance. You can find out more in our Recognition Information leaflets:
1.3 *Particular careers: social work (including probation and community work), nursing and midwifery, general practitioners*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

For the future

U205 may be presented for the last time in 2000.

S324

ANIMAL PHYSIOLOGY

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

Physiology is the study of how organisms function. Some physiologists are interested more in the detailed mechanisms that underlie the functions of individual systems of the body, perhaps the digestive system or the respiratory system. Our interest, on the other hand, is in the physiology of the whole organism, and particularly in how the activities of the various physiological systems are integrated to adapt an organism to different environments.
The emphasis in this course is on the functioning of vertebrate animals. Although we naturally have an interest in human physiology, we use human examples to illustrate the variety of solutions that have evolved to cope with the problems posed by different ways of life and habitats. Television programmes are used throughout the course to illustrate the biological principles covered in the texts.
The aims of the course are:

- To illustrate some of the recent advances in whole-animal physiology.
- To advance your critical skills as applied to important physiological principles, and increase your understanding of experimental design and method.
- To teach you to design physiological experiments of the kind conducted in modern laboratories, and to make appropriate deductions from quantitative data.
- To enable you to demonstrate an understanding of how different physiology systems act together in the whole animal.

The outline of the course is:
Introduction to animal physiology and reproductive physiology
Thermal balance and heat production
Responses to heat and cold
Hibernation
Shortage of oxygen
Growth, maturation and ageing
Consequences of size
Muscles, tendons, bones and joints
Muscles and contractility
Swimming and buoyancy in fish
Flight in birds and bats
The whole-organism approach is followed throughout the course. We begin by introducing the subject of whole-animal physiology and some of the non-invasive techniques that can be used to study energy flow in animals. Then we follow an ontogenetic theme, considering the changes in physiology that occur throughout an animal's life. First we deal with reproductive physiology, covering egg and sperm production, fertilization, the placenta and the development of the foetus, then with nutrition in the foetus, leading to an explanation of the problems that mammals face when they are born into a relatively hostile environment, particularly the problem of temperature regulation. Then we consider how adult animals cope with the problems associated with severe environments, both those that are extremely hot or cold and those that are lacking in available oxygen.
The second half of the course is concerned primarily with animal performance, particularly in relation to the expenditure of energy. We set the scene by considering the anatomical and physiological changes that take place during growth of the organism and the effects of age and body-size on the cellular and whole-organism aspects of physiology. To understand the physiological basis of animal activity we need to know something of the structure and function of the tissues of the body that are implicated in movement, notably the muscles, tendons, bones and joints. There is particular emphasis on two different styles of movement: swimming in fish and flying in birds and bats. We are especially interested in the variety of physiological processes (such as respiratory adaptations and changes in the circulation) that play a part in these kinds of locomotion, and in overall performance in relation to energy expenditure. The course emphasizes animals' performance in natural conditions. Much of what we describe comes from observations of animals, but most knowledge comes from experimentation and a course such as this has to report the results of some painless experiments on living animals. If you believe that animal experimentation is not a justifiable means of furthering our knowledge of animal and human physiology, you are advised not to undertake the course. You would not be asked to perform experiments on living animals yourself, but you would be concerned with the results of such experiments and you would be working on dissected animal tissues at the residential school.

Advice to applicants

The course is of particular interest to those who have a general concern for biology and those engaged in teaching and research. Many students may be interested because of the course's relevance to the medical and paramedical fields. You should have an interest not just in human biology but also in how other animals function. You are expected to have a good scientific background and in particular a good grounding in biology. You should be familiar with basic animal biology, including biochemistry and development. Biology to A-level standard with a good level of physiological knowledge is the minimum requirement. If your knowledge is at O-level standard it will be difficult to do well, though with extra effort it might be possible to pass the course. You could get a good idea of the level of study by looking at the University's science foundation course (S102) or at S203 *Biology: form and function*. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you have time, it would be useful to read one of:
Schmidt-Nielsen (1984) *Animal Physiology*, 3rd edition, Cambridge University Press
M. Yarnell, M. Harding (1996) *Physiological Processes*, McGraw-Hill Book Company
R. Eckert, D. Randall, G. Augustine (1988) *Animal Physiology*, W. H. Freeman

If you are disabled

You could probably cope with all the essential parts of the course as long as you have adequate help, but you might find the practical work difficult. Printed course material is available on audio cassette, and there are transcripts of the course cassettes and television programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Four study texts

Broadcasts and cassettes
Twelve television programmes
Two radio programmes
Two audio cassettes

You will need

Colour television
Audio cassette player
Radio

Residential school

This course shares a one-week summer school with S327 *Living processes*. The programme consists of an intensive laboratory practical in the form of a project, either like a student research investigation, requiring the study of the structure, physiological properties and natural function of insect muscle or of mammalian brown adipose tissue. In the evenings there are tutorials and video cassettes that supplement and extend the course material. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S324 this rule can apply to one assignment. You will be the project report on the summer school work. If you have already attended the school as part of S327, or if you take both S324 and S327 in 1997, you will have to complete an alternative project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S324 overlaps with the discontinued course S321, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the Institute of Biology. You can find out more in our Recognition Information leaflet:
3.8 *Membership of professional bodies: scientific institutions*
You can get this from your Regional Centre.

S327

LIVING PROCESSES

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

What is life, or more accurately what distinguishes living from non-living processes? How do living systems transform energy and material? What is the basis of biological organization? How does it reproduce? In the last twenty years the development of extremely

precise analytical techniques has produced a huge increase in our detailed knowledge of biological molecules and their dynamic interactions, but researchers in the different disciplines of biology, chemistry and physics have tended to pursue their own studies in relative isolation. This interactive course draws together recent discoveries and advances from all fields and examines them in the light of the perennial questions about the nature of life, and in a streamlined way so that you will not lose sight of the wood for the trees. The course also explains how recent findings have led to our understanding of living processes, away from a reductionist, static view and a mechanistic framework to a dynamic picture of communication, of spontaneity and self-organisation beginning at the level of molecules. For example, those behavioural molecules studied in projects and images of molecularly sculpted bacteriorhodopsin cells in electron micrographs are motivating the way we now express the continuity between movement – emotional, behavioural and motivational – that characterises the spontaneous responsiveness of the living world.

The course is divided into four parts:

The organisation of living matter
What a life!
The structure of living matter
The environment of living matter and their interactions
Macromolecules

Bioenergetics
Energy flow and metabolism
Photosynthesis, light and life
Conducted and muscular activity

Biocommunication
Biodiversity and homeostasis
Signals and receptors
Biological rhythms and biocommunication
Cellular networks

Processes of heredity
Cellular heredity
Patterns of gene expression

This is an interdisciplinary course and is not closely related to S324 *Animal physiology* even though the two courses share a residential school.

Advice to applicants

You are expected to have a sound science background and to be familiar with the terms, concepts and principles introduced in the Open University science foundation course, S102. You should not take the course if you scored less than 60% for chemistry or physics in S102.

If you have no scientific background at all, you are advised to read the biology, chemistry and physics units of S102, the science foundation course and make yourself familiar with the material to the standard mentioned above. Your Regional Centre will be able to tell you where you can see reference copies of S102, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. You should also take the S102 maths diagnostic test on logarithms, algebra and graphs, which will be sent to you in a course mailing.

The books of unit S327 studies include correlation and critical interpretation of research review papers.

If you are disabled

You may have difficulty in manipulating apparatus at the residential school. Many parts of the course are difficult to record because they rely heavily on complex diagrams, but we hope to devise alternative methods of presentation. There are no recordings of the printed materials but there is a transcript of the video cassette. You can get more information and advice from the S327 course manager, telephone 01908 653522. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Four study texts
Case studies
Notes to accompany the cassette
One video cassette
Television (preferably colour)
Video cassette player (VHS)

Residential school

This course shares a one-week summer school with S324 *Animal physiology*. The fee for the school (£199 in 1996) is not included in the course fee. The programme consists of an intensive laboratory practical in the form of a project, rather like a modest research investigation, requiring the study of the structure, physiological properties and natural function of dissected insect muscle or of mammalian brown adipose tissue. In the evenings there are tutorials and video cassettes that supplement and extend the course material. After the school you will be asked to prepare a scientific paper based on your investigations.

Assessment

There are four tutor-marked assignments (one is a project) and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S327 this rule can apply to one tutor-marked assignment but not to the project. If you have already attended the school as part of S324, or if you take both S324 and S327 in 1997, you will have to complete an alternative project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre. If you have any questions about recognition by the Royal Society of Chemistry please write to Dr. R. Hill, Chemistry Department, Science Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA.

S327
ECOLOGY

This is a 30-point course at Level 3, with a one-week residential school.
Use of a personal computer is optional.

The course

The science of ecology is the study of interactions between organisms and their environment, including interactions with other organisms in the environment. The course will make you aware of the interrelationships between living organisms, give you some of the skills and knowledge appropriate to an intending professional biologist or ecologist, and develop your understanding of the relationships between ecology and society (including technology). We feel strongly that the experimental approach is the most likely to lead to improvements in understanding principles and in making predictions and constructing models, so we have stressed experimental investigations.

The main course texts are five books, each with its own companion text, and a project guide.

Book 1 *Organisms and interactions* introduces the subject through a wide-ranging survey of the diversity of ecological interactions among animals, plants and microbes. The ecological consequences of these interactions are emphasised and the roles of physical and chemical factors in air, soil and water are investigated.

Book 2 *Population ecology* considers how and why wild animals and plants become more or less abundant, and how competition and predation may cause fluctuations in population.

Book 3 *Community ecology* asks how the diversity of species in communities is determined and examines the role of history and dispersal in the patterns of distribution of species.

Book 4 *Ecosystems* examines the role of primary producers, consumers and decomposers in ecosystems, and how they are linked by energy flow.

Book 5 *Humans and ecology* discusses the conflicts of interest between conservation, food production and increase in human population in the light of ecological principles developed earlier in the course.

Practical fieldwork is carried out in two important parts of the course: a one-week residential school at a Field Studies Council Centre, and an individual project that you plan and carry out in your home area. Advice and support for this is provided by the project guide, which includes advice about the analysis of results and the use of statistics, by a video cassette and by working closely with a course tutor. Most of your contact with your tutor will be to do with your project, and two of the assignments are related to it.

Advice to applicants

You are expected to have some scientific background and a basic knowledge of biology. You should be familiar with the following terms, although they are defined in the course: autotrophe, respiration, heterotrophe, photosynthesis, population, species. You are advised to make yourself familiar, if you are not so already, with the interpretation of graphs and the use and properties of logarithms. You must be able to use a calculator for simple arithmetic operations. You can get an idea of the level of study by looking at the University's science foundation course (S102) or at S203 *Biology: form and function*, S280 *Science matters* or U206 *Environment*. Book 1 of S203 would be particularly useful as it includes a 'Survey of Living Organisms'. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

We recommend any of:

M. Begon, J. L. Harper, C. R. Townsend (1986) *Ecology*, Blackwell Science

C. J. Krebs (1994) *Ecology: the Experimental Analysis of Distribution and Abundance*, 4th edition, Harper and Row

C. M. Pond (1991) *The Diversity of Organisms*, Hodder and Stoughton/The Open University. This is Book 1 of S203 *Biology: form and function* and includes a 'Survey of Living Organisms'.

Any of Collins' New Naturalist Series (on plants, animals, or parts of the British Isles) would be worth reading to give you some background to organisms and communities in the British Isles.

If you are not familiar with logarithms, powers of ten or the use and interpretation of graphs, you should study the introductory pack for the science foundation course, S510 *Into science*, available from the Learning Materials Sales Office, telephone 01908 652185.

If you are disabled

You could probably cope with essential parts of the course, including the fieldwork, as long as you have adequate help, though if you have a severe visual disability you may have great difficulty. Printed course material is available on audio cassette and we hope to have transcripts of some of the broadcasts and course cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five books, each with a companion text
Project guide
Glossary

Broadcasts and cassettes
Six television programmes
Two video cassettes
Two audio cassettes

You will need
Colour television
Video cassette player (VHS)
Audio cassette player

Optional
Computer exercises will be used at the residential school and you can buy the software for use at home. If you want to take advantage of these optional exercises you will need a computer as described in the leaflet *Personal Computing for Open University Courses: 1996/97* (available from your Regional Centre).

Residential school

One-week schools are held in April and May at centres run by the Field Studies Council. The schools all have a common content but details will differ because of the local habitats and the species of plants and animals to be studied. The emphasis is on terrestrial and freshwater habitats, and field exercises are chosen to illustrate basic ecological principles and problems. By the end of your field study week you should be in a much better position to complete your fieldwork project. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments (two are course-related and two to do with the project), four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S328 this rule can apply to one tutor-marked assignment and one computer-marked assignment, but not to the project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S328 overlaps with the discontinued courses S323 and S326, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institute of Biology. You can find out more in our Recognition Information leaflets:

3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

S328
OCEANOGRAPHY

This is a 30-point course at Level 3.
It has no residential school and requires no computing equipment.

The course

This is the most interdisciplinary course presented by the Earth sciences discipline. Oceanography is a 'whole Earth' science, for the oceans cover seventy per cent of our globe and interact continuously with the solid Earth beneath and the atmosphere above, while providing the setting for a large part of the planet's biological production. Physics, chemistry and biology are all prominent in the course because their relationship in the marine

environment is the essence of oceanography. The aims of the course are to:

- Provide a scientific basis for understanding the oceanic environment.
- Illustrate the multidisciplinary and interdisciplinary nature of oceanography.
- Show how the oceans have changed.
- Demonstrate the observational, experimental and theoretical methods that have led to our present knowledge of the geology of the ocean crust, the physical and chemical characteristics of ocean water and marine ecology.
- Demonstrate the influence of technological advances on our knowledge of the oceans.
- Investigate the economic potential of the oceans.
- Give you an understanding of the dependence and effects of human beings on the oceans, and the environmental and legal problems involved in the responsible management of the oceans.
- Develop your skills in using data from more than one discipline in the analysis of oceanographic situations, and in the discussion and use of scientific information in recent oceanographic research papers.

The course consists of seven volumes, one of which is the set book.

Ocean basins – their structure and evolution is an introduction to the oceans and the ocean basins. It considers the oceans as a resource, the structure and composition of ocean crust and the effects of hydrothermal circulation.

Seawater – its composition, properties and behaviour is about the composition, temperature and density of seawater, in particular with respect to different water masses; also the transmission of light and sound in the oceans.

Ocean circulation examines surface and deep currents, with emphasis on the interaction between the ocean and the atmosphere.

Waves, tides, and shallow-water processes is about the movement of muds, sand and gravels, and the formation of bed forms such as sandbanks and ripple marks. The set book, *Biological Oceanography: an Introduction*, deals with marine biology in the context of the oceans as a whole.

Ocean chemistry and deep-sea sediments describes the supply of terrigenous sediments to the deep sea, and chemical fluxes and cycles in the ocean.

Case studies in oceanography and marine affairs begins with a discussion of the development of the Law of the Sea. Then come two case studies, on the Arctic Ocean and the Galapagos Islands, that illustrate the interdisciplinary nature of oceanography and the practical and legal problems involved in exploitation and management of the ocean.

Advice to applicants

You are expected to have good passes in the University's science foundation course (S102) and, ideally, in S280 *Science matters*, and also in at least two science courses at Level 2, preferably in different disciplines. Physics, chemistry, biology and Earth sciences all play a prominent part in S330, so the more diverse your Level 2 science background the easier you will find the course. If you have not completed any Open University science courses, you should have some background knowledge (at least to O-level or GCSE standard) of the four science disciplines, and a higher level of knowledge of at least two of these areas is desirable. If you have no background in the four sciences you will find the course very difficult and you are advised not to undertake it.

The basic principles of physical oceanography are the key to understanding many aspects of the science as a whole, but the 'physical' concepts in S330 are not much more complex than those to be found in the science foundation course, and are probably simpler than anything in physics courses at Level 2. The course does not have a strong mathematical bias, but some mathematical knowledge (again to O-level or GCSE standard) is assumed.

Preparatory work

If you have a good background in each of the four sciences concerned you need not do much preliminary reading, but you would find it useful to read at least one general oceanographic book such as

R. Barton (1980) *Secrets of the Ocean*, Aldus Books

R. A. Davies (1979) *Principles of Oceanography*, Addison Wesley, 2nd edition

A. C. Duxbury (1971) *The World and its Oceans*, Addison Wesley

T. Garrison (1993) *Oceanography: an Invitation to Marine Science*, Wadsworth Publishing Company (UK distributors Chapman and Hall)

M. Grant Gross (1988) *Oceanography: a View of Earth*, Prentice-Hall, 4th edition

J. V. McCormick, J. M. Thiruvathukal (1985) *Elements of Oceanography*, Holt-Rinehart and Winston

K. Stowe (1983) *Ocean Science*, Wiley, 2nd edition

H. V. Thurmann (1993) *Essentials of Oceanography*, Macmillan Publishing Co., 4th edition

H. V. Thurmann (1993) *Introductory Oceanography*, Macmillan Publishing Co., 6th edition.

J. S. Weisberg, H. F. Parish (1974) *Introductory Oceanography*, McGraw-Hill

A. B. C. Whipple (1983) *Restless Oceans*, Planet Earth series, Time-Life Books

If you are disabled

The course contains relatively complex visual material that is difficult to present in different ways. There are no recordings of the printed texts, but transcripts of most of the broadcasts and course cassettes can be provided. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six study text volumes
Study notes for the set book
Glossaries for the volumes and for the set book
'Data bank' of useful conversions etc.
Notes to accompany the broadcasts and cassettes
Two world ocean-floor maps

Broadcasts and cassettes
Nine television programmes
Three audio cassettes
Video cassette

You will need to buy

Set book
C. M. Lalli, T. R. Parsons *Biological Oceanography: an Introduction*, Pergamon, £22
(1996 price)

You will also need

Television (preferably colour)
Audio cassette player
Video cassette player (VHS)
Calculator

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S330 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Award

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject matter of S330 overlaps with the discontinued course S334, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the Institute of Biology or of the Institution of Water and Environmental Management. You can find out more in our Recognition Information leaflets:

3.4 Membership of professional bodies: Institution of Water and Environmental Management

3.8 Membership of professional bodies: scientific institutions

You can get these from your Regional Centre.

S341
SEDIMENTARY PROCESSES AND BASIN ANALYSIS

This is a 30 point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

This Earth science course is designed to make you aware of:

- Some of the key concepts used in palaeoenvironmental and basin analysis.
- The economic applications of such concepts.
- The influence on their development of technological advances in measurement.
- How 'doctrines' or paradigms have changed as the soft rock area of geological science has advanced.

The course is also intended to develop your skills in:

- Describing and interpreting geological materials in the field and the laboratory.
- Describing and interpreting data sets such as stratigraphic sections, lithofacies maps, borehole logs and seismic sections.

There are four main parts to the course. *Siliciclastic sediments and environments* and *Carbonate sediments and environments* examine both the petrography and the depositional environments of sedimentary rocks. They use the home experiment kit and two set books, *Sedimentary Petrology* and *Facies Models*, with extensive study commentaries.

Basin analysis techniques deals in detail with geophysical well-logging, seismic reflection profiling, seismic stratigraphy and tectonics of extensional and thrust-belt terrains. There are brief discussions of source rock studies, micropalaeontology, isotope geochemistry and gravity and magnetic methods.

The *Case study* gives you an opportunity to apply the knowledge and skills you have acquired to a study of the North Sea, using the set book *Introduction to the Petroleum Geology of the North Sea*.

The video programmes are used:

- To take the role of a 'demonstrator' in the practical parts of the course, showing worked examples of descriptions and interpretations.
- To help you to grasp spatial and temporal phenomena (the third and fourth dimensions).
- To give you fieldwork experience, showing rock outcrops and modern environments where rocks are in the making.
- To give insights into the economic applications of the subject and the environment in which professional geologists work.

Advice to applicants

This is a specialist course and you are expected to understand the essentials of sedimentary environments and the processes acting within them. You could get the necessary background from the University's science foundation course (S102) and S236 *Geology*. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

Revising S236 *Geology* would be useful preparation.

If you are disabled

If your sight is severely impaired you may have substantial difficulty with aspects of the course such as maps and the microscope, and there are no recordings of printed course material. Because of the fieldwork, the residential school will be impossible if you have severe difficulties with mobility. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Four study commentaries
One study text
Selection of reprints
Booklet of fossils in thin section
Map of oil and gas concessions in the North Sea (by courtesy of Shell)

Home kit
You will be lent an experiment kit consisting of a petrological microscope, about twenty rock samples and thin sections, a hand lens, two of the set books, *Facies Models* edited by R. G. Walker (1992, Geological Association of Canada), and *Sedimentary Petrology* by M. E. Tucker (second edition 1991, Blackwell Scientific Publications).

Outside the UK
Because of restrictions on the kit you can take this course in certain countries only. You can get more information from your Regional Centre.

Cassettes
Five video cassettes

You will need to buy

Set book
K. W. Glennie (ed.) *Introduction to the Petroleum Geology of the North Sea*, Blackwell Scientific Publications, 3rd edition (unless 4th edition is available by late 1996), £32.95
(1995 price)

You will also need

Colour television
Video cassette player (VHS)

Residential school

The one-week summer school, held at the University of Durham, will give you experience designed to develop the following skills:

- Logging sequences of rocks, examining other tectonic structures and making systematic field observations.
- Following this up by petrographic studies.
- Making environmental interpretations based on the field and laboratory studies.
- Describing core samples of sedimentary rocks.
- Interpreting borehole logs and seismic sections.
- Integrating your studies at the school with literature reviews and the regional geology of selected areas.

The school programme gives an introduction to the structural and stratigraphic framework of northern England and its relationship to the North Sea area. The fee for the school (£159 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S338 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Award

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject matter of S338 overlaps with the discontinued courses S333, S335 and S337, you can count only one of the four towards a BA or BSc.

Vocational qualifications
This course can contribute to the award of a National or Scottish Vocational Qualification. We will send you more information if you register for the course.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflet:
3.5 *Membership of professional bodies: Institute of Wastes Management*
You can get this from your Regional Centre.

For the future

This course will be presented for the last time in 1998. It will be replaced in 1999 by another course in the same subject area.

UNDERSTANDING THE CONTINENTS: TECTONIC AND THERMAL PROCESSES OF THE LITHOSPHERE

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

The course is designed to:

- Give you an insight into areas of current interest and active research in hard-rock Earth sciences, developed through the theme of crustal and mantle evolution throughout geological time.
- Develop concepts of igneous and metamorphic geology and geochemistry, geophysics and structural geology, and show how they have contributed to the development of Earth sciences in the last ten years.
- Demonstrate how detailed studies of active geological provinces can enable us to interpret older analogous provinces within the geological history of the United Kingdom.
- Teach the techniques that are used by geophysicists to evaluate geological models that describe the processes by which the lithosphere evolves.

The course is presented in six sections. The first reviews the physical properties of lithospheric plates. The development of the lithosphere on a global scale and, more specifically, the British lithosphere is introduced through tectonic and geophysical case studies.
The second section examines extensional regimes and their associated magmatism, with the Red Sea and the East African Rift as modern examples and the Carboniferous Midland Valley of Scotland as an older example.
The third section looks at subduction zones, sites of intense tectonic and magmatic activity and associated mineralization. These are believed to be of great importance in the formation of continental crust. The Aegean Island arc (Santorini) and the Andean plate margin are contrasted with the products of a similar setting during the Lower Palaeozoic of Wales and northern England.
The fourth section takes examples from the Alps and from the Moinian and Dalradian rocks of central Scotland to describe the principles of continental collision, which may bring to an end the plate tectonic processes of ocean formation and lithosphere subduction.
The fifth section draws the strands together, taking the Himalayas as a case study of tectonic and magmatic processes at an active plate margin.
The last section investigates deep crustal processes and the tectonic and magmatic processes that took place during the early history of the Earth.

Advice to applicants

You are expected to understand the essentials of igneous and metamorphic rock formation processes, including igneous and metamorphic rock classification and geochemistry (e.g. three-component phase diagrams), structural processes and geophysical techniques, as well as the main features of plate tectonic theory. If you are not familiar with these topics you are advised to study first the University's Level 2 Earth science courses S236 *Geology* and S267 *How the Earth works: the Earth's interior*, which cover them. You might also find those course materials useful as revision. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

Complex diagrams and microscope work are a necessary part of the course as a whole and of the residential school, and there are no recordings of printed course material. Fieldwork at the school is strenuous and means walking over rough terrain. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts
Notes to accompany the video cassettes
Notes to accompany the experiment kit
Aeromagnetic and Bouguer anomaly maps and the Condie tectonic map of the world
A seismic section from the North Sea
Book of colour plates illustrating the texts

Cassettes
Four video cassettes

Home kit
You will be lent an experiment kit consisting of a petrological microscope, a hands lens, a set of rocks and thin sections.

Outside the UK
You will need to provide a mains lead for the microscope.

You will need to buy

The Geological Survey 1:250,000 Solid Tay Forth sheet. An order form for this is included in the first mailing of course material.

You will also need

Television
Video cassette player (VHS)

Residential schools

The one-week summer school, held at the Kindrogan Field Centre near Pitlochry in Scotland, offers both field and laboratory work. The accommodation is fairly spartan and you may be expected to share a room. The fee for the school (199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S339 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S339 overlaps with the discontinued courses S333, S336 and S337, you can count only one of the four towards a BA or BSc.

For the future

This course will be presented in its present form for the last time in 1999. It will be revised section by section, starting in 2000.

INORGANIC CHEMISTRY

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

The aims of the course are to develop a critical understanding of the main areas of inorganic chemistry and to apply data from primary sources (such as research papers) and secondary sources (review articles, course texts) to solve problems both in chemistry and in other related fields.
The course begins with a study of three first-row transition elements. This is then extended to look at the first transition series as a whole, seeing how some important physical and chemical properties vary as we move across a transition series. Next we show how crystal field theory, molecular orbital theory and thermodynamic analysis can be used to explain the observations we have made and, in doing so, extend the treatment of symmetry. The first half of the course ends by looking at the structure and stereochemistry of some transition metal complexes. The technique of nuclear magnetic resonance is discussed and used to solve structural problems.
The rest of the course is divided into four sections, each examining an area in which inorganic chemistry has a significant effect on modern society. Organometallic chemistry gives us the means to custom-build molecules to perform special roles, to design catalysts and to aid stereospecific synthesis. Progress in high-temperature superconductivity and its potential for revolutionizing the electronic and electrical industry is part of solid-state chemistry. Designer ceramics and zeolites are two other exciting areas.
It is now recognized that metals play a crucial role in the metabolism of plants and animals, and inorganic chemistry is important in unravelling metabolic complexities. Completing the main text is a study of the chemistry of the transuranic elements and an assessment of how this knowledge can be applied to the problems associated with nuclear fuel manufacture and its reprocessing.
As well as the course texts there is a selection of original published papers.

Advice to applicants

You are advised to prepare yourself for this course by taking the science foundation course (S102), S246 *Organic chemistry* and S247 *Inorganic chemistry: concepts and case studies*. S343 relies particularly on the material in S247, which covers most of the necessary background. If you have not taken those courses you should make sure that your knowledge of chemistry is adequate. You can get an idea of the level required by looking at S247. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

You might find the following useful as background reading.
A. G. Sharpe *Inorganic Chemistry*, 3rd edition 1992, Longman
J. E. Huheey *Inorganic Chemistry*, 3rd edition 1993, Harper-Collins

If you are disabled

If you have *severely* restricted mobility or manual dexterity or a severe visual disability you might have difficulty at the residential school. There are no recordings of printed course material but there are transcripts of the course cassettes.

Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Nine study texts
A collection of original papers
Notes to accompany the audio cassette
Notes to accompany the video programmes

Cassettes
Two video cassettes
One audio cassette

Kit
A model kit for the construction of molecular models is used extensively throughout the course.

You will need

Video cassette player (VHS)
Audio cassette player

Residential schools

The one-week summer school is shared with S344 *Organic chemistry: a synthetic approach*. (If you take both courses you need attend the school only once.) The school, usually held at York University, consists largely of project-linked laboratory work together with tutorials and problem-solving sessions in the evenings. The fee for the school (£199 in 1996) is not included in the course fee.

Revision weekend
A weekend revision school for this and other chemistry courses is usually held shortly before the examination. This is not formally part of the course and a fee is charged for attendance. For more information please ask the S343 Course Manager, Chemistry Department, Science Faculty, The Open University, Walton Hall, Milton Keynes MK6 7AA.

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S343 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S343 overlaps with the discontinued courses S304, S351 and S352, you can count only one of the four towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Royal Society of Chemistry. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

S344

ORGANIC CHEMISTRY: A SYNTHESIS APPROACH

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

Organic chemistry is a subject that affects our daily lives in many different ways. 'Histamine discovery could help insomniacs'; 'Malaria vaccine may be close'; 'Sex lure keeps tabs on crop pests'. These headlines from recent newspaper and magazine articles draw attention to progress in the development of new substances for use in health-care and agriculture. It is one of the aims of the course to explore, by means of a carefully graded series of case studies, the many facets of the complex process involved in the discovery and use of such substances.

The course is also designed to stimulate your interest in and increase your knowledge and understanding of advanced organic chemistry, through the medium of organic synthesis. It introduces a wide range of modern organic reactions, with particular emphasis on those with a high degree of selectivity, illustrating their use for the synthesis of organic compounds of interest in chemical research and in industry. The case study materials have the additional role of developing your skills as an independent learner and in problem-solving. The aims of the course are:

- To introduce a range of organic reactions of particular value for the synthesis of given molecules with specified structures and stereochemistry. The emphasis is on modern reactions capable of a high degree of selectivity and on the mechanistic basis of that selectivity.
- To introduce modern methods in synthetic organic chemistry, *including spectroscopic and separation techniques that can be used* to isolate and determine the detailed structure *(including stereochemical features) of an unknown* compound.
- To engage you, through case studies, in a variety of problems that require the critical evaluation of two or more different routes to the same compound.
- To improve your skills as an independent learner by gradually introducing more unstructured materials; developing your ability, for example, to extract information from the chemical literature and to solve a given problem to do with the synthesis of target compounds.

The course is arranged in eight sections, with four case studies:

Fundamentals of organic synthesis
Strategy and selectivity
Electronic and steric effects
Elements of stereochemistry
High performance liquid chromatography and the synthesis of stereoisomers of cyclosoleucylisoleucine – a practical project
Case study 1 Peptide synthesis
Spectroscopy and structure
Mass spectrometry
Infrared spectroscopy
Nuclear magnetic resonance spectroscopy
Functional group interconversions: oxidation and reduction
Organoheteroatom reagents. addition and coupling reactions
Case study 2 Pheromones
Enols, enolates and enamines: formation and alkylation
Enols, enolates and enamines: condensation reactions
Case study 3 Prostaglandins
Synthesis of cyclic compounds
Case study 4 Penicillin and beyond – the β-lactam antibiotics

The course begins with revision and extension of the disconnection approach to organic synthesis strategy. Treatment of electronic theory and stereochemistry is the basis for understanding a wide variety of types of reaction and of organic reactivity in general; special attention is given to the use of selective reactions to achieve a particular molecular transformation. Modern chromatographic and spectroscopic techniques for the purification and identification of organic compounds are also introduced. The case studies illustrate in detail the use of both theoretical concepts and experimental techniques in organic synthesis.

Advice to applicants

The course offers an introduction to organic synthesis for those who have an interest in science education or in industry, especially the pharmaceutical industry. You need an understanding of basic organic chemistry such as you would get from S246 *Organic chemistry*, which you are advised to take before this course. Your Regional Centre will be able to tell you where you can see reference copies of S246, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

Although the residential school includes a considerable amount of laboratory work and there is quite a lot of audio-visual material, no-one should be deterred from taking this course. But if you have a severe visual disability or restriction of mobility you may find some parts of it very difficult. There are no recordings of printed course material, but transcripts of the video cassettes are available. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Study texts
Notes to accompany the cassettes

Cassettes
Two video cassettes
Four audio cassettes

Home kit
You will be lent a home experiment kit that contains the equipment and materials you will need for a 'mini-project', which will be one week's work. Chemistry is an experimental science in which theory is based firmly on experiment. The project has been designed as an integral part of your studies, and it is important that you perform it to gain full benefit from your work.

Outside the UK
Because of restrictions on sending the kit overseas this course is not available in Austria, Denmark, Finland, Gibraltar, Greece, Italy, Portugal, Slovenia, Spain, Sweden or Switzerland.

You will need to buy

Set book
J. McMurry (1992) *Organic Chemistry*, 3rd edition, Brooks/Cole, £22.50 (1996 price)
The fourth edition of this book will be published in 1996. If you have difficulty in finding a third edition, please buy the new edition.

You will also need

Video cassette player (VHS)
Audio cassette player

Residential school

This course shares a one-week summer school with S343 *Inorganic chemistry*. (If you take both S343 and S344 you need attend the school only once.) The programme consists mainly of laboratory work during the day and tutorials in the evenings. The fee for the school (£199 in 1996) is not included in the course fee.

Revision weekend
A weekend revision school for this and other chemistry courses is usually held shortly before the examination. This is not formally part of the course and a fee is charged for attendance. For more information please ask the S344 Course Manager, Chemistry Department, The Open University, Walton Hall, Milton Keynes MK6 7AA.

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated 'S' which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. It is mandatory for admission to graduate or licentiate membership of the Royal Society of Chemistry, and is also included in the Open University degree profiles recommended by the Institute of Energy and other bodies. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

S357

SPACE, TIME AND COSMOLOGY

This is a 30-point course at Level 3.
It has no residential school and requires no computing equipment.

The course

This course, which replaces S354 *Understanding space and time*, is arranged in four 'blocks' of work. Block 1 discusses Newtonian mechanics: a view of the world introduced in 1687 that remained virtually unchallenged until the work of Albert Einstein at the beginning of our own century. We try to avoid complicated mathematical and technical details in order to concentrate on the fundamental concepts: ideas such as the isotropy of space, the homogeneity of time and the principle of relativity. Many courses describe the applications of Newtonian mechanics, but we concentrate on the assumptions about space and time that are implicit in Newton's theory.

Block 2 begins by surveying, with the help of experiments shown on video, the experimentally established laws of electricity, magnetism and light. The theory of electromagnetism leads us to see that the Newtonian view of the world needs to be modified. We take a first look at the new (1905) view developed by Einstein in which time is no longer absolute. We build on the Einstein picture and develop expressions for the most famous special-relativistic effects such as 'length contraction', 'time dilation' and the so-called 'twin paradox'. Quite a lot of algebra is used but the steps are easy to follow. Next we emphasize Einstein's new space-time approach to physics, and go on to generalize the definitions of the linear momentum and energy of a particle appropriate to the new world view of special relativity. We see how the law of momentum conservation allows for the conversion of mass and energy, and arrive at Einstein's famous equation $E = mc^2$.

At the end of Block 2 there are revision exercises on Block 1 and Block 2.

Block 3 describes the remarkable changes that the advent of general relativity has made to our understanding of space and time. These changes lead to a theory of gravitation that supersedes Newton's, a theory in which the nature of space and time is intimately related to the distribution of matter in the universe. We begin by showing that the nature of space-time appropriate to special relativity is inadequate to describe the experiences of accelerating observers. This inadequacy applies to observers at rest under the gravitational influence of a large distribution of matter such as the Earth or the sun. The basis of this argument, Einstein's principle of equivalence, can be tested and we describe those experiments. We emphasize that the nature of space-time is closely related to a dynamic theory. Then we explain what is meant by 'curved space-time' and show how general relativity describes the motion of particles in a curved space-time. Because of the success of Einstein's predictions we have confidence that the nature of space-time as described by general relativity is the most accurate and comprehensive picture of space-time that we have.

The last part of this block turns to the prediction of general relativity in the most extreme conditions of matter collapsing to form black holes. It seems likely that black holes have been formed in the universe, and there is now clear evidence of their existence.

Block 4 applies general relativity to cosmology: the study of the universe as a whole, its history from the 'Big Bang' and its possible future destiny. The starting point is a discussion of the three observational pillars of modern cosmology: the microwave background radiation that fills the entire universe, the recession of distant galaxies as described by the Hubble law, and the relative abundance of the different light elements. We then present a description of the expanding universe founded on general relativity, a description that must encompass the curved nature of space-time on a cosmic scale. We end with an account of the manner in which the composition of the universe is linked to its origin and possible destiny. This brings in pioneering topics such as 'inflation'.

The course concludes with revision based on detailed solutions to specimen examination questions.

Advice to applicants

Although the course presents relativity in a much less mathematical way than is usual, you *must* nevertheless be fluent in several mathematical skills: differential and integral calculus, vectors and an awareness, at least, of differential equations. A good pass in MST204 *Mathematical models and methods* would be ideal preparation; M101 *Mathematics: a foundation course* or MS284 *An introduction to calculus* would be the bare minimum. Familiarity with physics concepts at the level of S271 *Discovering physics* would be an advantage, and is essential if your mathematics background is weak in vectors. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from them from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

There is no special preparatory work, but you can get more detailed information about the necessary background mathematics by sending a large self-addressed envelope (at least 30cm x 21cm) to the S357 Course Manager, Physics Department, The Open University, Milton Keynes MK7 6AA.

If you are disabled

This course has many complex diagrams that are part of the detailed mathematical argument, and there will be no recordings of printed course materials in 1997, the course's first year. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Four study texts
Introduction and guide
Glossary
Yearbook
Course index
Video notes

Broadcasts and cassettes
Four video cassettes
Four audio cassettes

You will need

Television
Video cassette player (VHS)
Audio cassette player

Basic scientific calculator

Assessment

There are four tutor-marked assignments, five computer-marked assignments (the first one will not count towards your course result) and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S357 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S357 overlaps with the discontinued course S354, you can count only one of the two towards a BA or BSc.

EVOLUTION

This is a 30-point course at Level 3, with no residential school.
Use of a personal computer is optional.

The course

This course is designed to give you a good general introduction to both the biological and the palaeontological aspects of evolution, since a comprehensive and up-to-date study of evolution requires the analysis of both living and fossil material.

The course is divided into four parts. Part I investigates microevolution. It discusses how organisms are adapted to their surroundings, and also how this can come about through the action of natural and sexual selection on the genetic variation within populations. Part II looks at the origin and extinction of species, discussing how studies of both living and fossil organisms can show how new species are formed. In Part III the emphasis moves to macroevolution and how variation in the rates of speciation and extinction over time and space can give rise to the large-scale pattern of living and fossil species that is observed today. Part IV consists of four evolutionary case studies, building on the earlier material in the course, about the origin of life, the plant invasions of the land (an audio-visual sequence), human evolution (a video programme) and evolution in the future.

The course will teach you to express models of evolutionary change in qualitative and in quantitative form and to test these models with observed data; to plan and carry out practical investigations into the evolution of living and fossil organisms and analyse the significance of the results; and to synthesize and write up the results of practical studies and studies of the literature of evolutionary phenomena.

To help you to achieve this the course includes two pieces of practical work. The first is an exercise in the analysis of some real and some replica fossils. The second is a project, for which there is a choice of biological topics. (You will need the use of a computer for one of the choices.)

Advice to applicants

You will be required to interpret graphs and tables of data and to carry out some practical investigations, involving measurement of specimens and analysis of the results. You need a background in science such as you would get from the University's science foundation course (S103), and you are also strongly advised to take first at least one Level 2 biology or Earth science course (or the equivalent), since S365 is considerably more advanced than S102. Your Regional Centre will be able to tell you where you can see reference copies of the foundation course and of the Level 2 courses S203 *Biology: form and function*, S236 *Geology* and SD206 *Biology: brain and behaviour*; you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

There are likely to be difficulties with the practical work in the kit exercise and the project. If you have impaired sight or manual dexterity you may have some trouble, but it can be overcome with suitable help. Course materials are available on audio cassette and there are transcripts of the audio and video programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
One study text
A study guide including notes to accompany the cassettes
Project notes
Kit exercise notes
Notes to accompany one of the audio programmes

Cassettes
Two audio programmes
Ten video programmes

Home kit
You will be lent a kit that contains a set of fossil specimens and plaster casts, together with callipers for measuring them, and also some items you will need if you choose certain of the topics for your project.

Outside the UK

You can take this course in Europe, but if you intend to study elsewhere you should seek advice from the course manager (telephone 01908 654809), since the kit contains grass seed that must not be imported into certain countries.

You will need

Television
Video cassette player (VHS)
Audio cassette player
If you choose the computer option for your project you will need a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments (one is a project), four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In S365 this rule can apply to one tutor-marked assignment but not to the project, and to one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of S365 overlaps with the discontinued course S364, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institute of Biology. You can find out more in our Recognition Information leaflets:
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

QUANTUM MECHANICS

This is a 30-point course at Level 3, with a one-week residential school.
It requires no computing equipment.

The course

This course will give you a thorough grounding in the principles and methods of quantum theory, and show how the theory can lead to quantitative results particularly in the field of atomic structure.

The course begins with an account of the experimental evidence of the atomic nature of matter, the existence of electrons and the atomic nucleus, and the wave nature of matter. This is followed by a mathematical description of wave motion and a grounding in some of the important mathematical techniques used in wave mechanics.

The Schrödinger wave equation is introduced and applied to simple problems including the rotational and vibrational properties of diatomic molecules, and the emission of alpha particles in radioactive decay. The structure of the hydrogen atom is studied in considerable detail.

Discussions of the wave particle duality, Heisenberg's uncertainty principle and the statistical nature of the predictions of quantum theory lead to a very thorough treatment of the postulates and mathematical structure of the theory.

There is an introduction to perturbation theory and the Pauli exclusion principle. These are applied to discussions of the structure of the helium atom and other multi-electron atoms, and the mechanism of atomic bonding in molecules.

Advice to applicants

You are expected to have a knowledge of physics and mathematics to A-level standard, although no knowledge of quantum mechanics is required. The basic physics material that is required includes Newtonian mechanics, electromagnetism and the wave nature of light. In mathematics, fluency in differentiation (including partial differentiation), integration of functions of more than one variable and algebraic manipulations are required as well as familiarity with vectors, complex numbers and linear second-order differential equations. You are strongly advised not to attempt this course unless your knowledge is at the standard of good passes in S271 *Discovering physics* and MST204 *Mathematical models and methods*. Your Regional Centre will be able to tell you where you can see reference copies of these, or you can buy them from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. It would also be a good idea to look at the set book (see below).

A self-assessed diagnostic quiz is available to prospective students; you should take it in the year before you begin the course. This will give you some idea of the sort of knowledge you need, and enable you to judge how far you can meet the requirements. You will then have an opportunity to do some preparatory work before the course begins. You can get a copy by sending a large (30cm x 21cm) stamped addressed envelope to The SM355 Course Manager, Physics Department, The Open University, Walton Hall, Milton Keynes MK7 6AA.

If you want a balanced view of physics at Level 3, we advise you to take S354 (or its replacement S357), SMT356 and SM355.

Preparatory work

You could make a good start by taking a preliminary look at the set book on which the course is built. You might want to look at relevant parts of a science foundation course: S101 Units 9–11 and 29–30 or S102 Units 4, 9–12 and 30–32. Units 3–16 of S271 *Discovering physics* introduce the physics of quantum theory, and MST204 *Mathematical models and methods* has useful units on complex numbers, vector calculus and elementary classical mechanics. You are also strongly advised to look at units covering the Fourier series and partial differential equations.

If you are disabled

There should be no serious difficulties, although if you have impaired manual dexterity you will not get the full benefit from the experiments at the residential school. There are no recordings of printed course material at present. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Course introduction
Five study texts
Glossary
Notes to accompany the video cassette

Cassettes
Two video cassettes
Four audio cassettes

You will need to buy

Set book
A. P. French, E. F. Taylor *An Introduction to Quantum Physics*, Chapman Hall, £19.95 (1995 price)

Eight of the sixteen course units are based on prescribed readings from the book. You will study about 70 per cent of the book, and 95 per cent of it is relevant to the course. You *must*, therefore, obtain a copy of it if you intend to take this course.

You will also need

Television
Video cassette player (VHS)
Audio cassette player
Calculator

Residential school

The one-week summer school, held at the University of Sussex, Brighton, includes experimental work and computer-assisted tutorial sessions. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, six computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In SM355 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of SM355 overlaps with the discontinued course SM351, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the Institute of Physics. It is also recognized by other professional bodies including the Institution of Electrical Engineers and the Institution of Nuclear Engineers. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.6 *Membership of professional bodies: the Institute of Mathematics and its Applications*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

For the future

This course is available in odd-numbered years only.

DIRECTED STUDIES COURSE IN CHEMISTRY: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY IN CHEMISTRY AND THE LIFE SCIENCES

This is a 30-point course at Level 3, with a weekend residential school.
It requires no computing equipment.

The course

This project-based course will appeal to students who have a keen interest in chemistry. It is intended for those who have almost completed an honours degree, offering an opportunity to undertake an independent piece of work similar to the directed project work carried out by final-year students at other institutions.

The course will give you a working knowledge of the principles and applications of modern nuclear magnetic resonance (nmr) spectroscopy, and the skills necessary for abstracting and assessing information to produce a coherent piece of scientific writing in a selected study topic.

The subject-matter is based on the versatile technique of nmr spectroscopy and covers its many applications in both chemistry and the life sciences. The approach is multinuclear and encompasses topics such as chemical shielding, modern pulse techniques including two-dimensional nmr, nmr of solids, ^{31}P nmr in biochemistry and aspects of nmr imaging.

The teaching material is equivalent to four standard course texts and is based on a set book that provides an introduction to modern nmr spectroscopy. Three audio cassettes support the written material. *The rest of the course is self-directed and* requires the preparation of a literature project in a selected topic area. Topics vary *from the purely chemical* to those leading *into the life* sciences: there is a wide choice and it is also possible to suggest a topic in an area not included in the list. The weekend school reinforces the teaching material and provides instruction in library methods. It also gives you an opportunity to decide on a particular literature project. After the school you are expected to use local scientific libraries to review and abstract the information relevant to your topic area, and to write up your project work as a dissertation (roughly 10,000 words).

Advice to applicants

You should have (or expect to have) 60 points from Level 3 chemistry courses with a pass at Grade 3 or higher; preferably your courses should include S343 *Inorganic chemistry*. If you are in any doubt about your ability to take the course please seek advice from the S442 Course Manager, Chemistry Department, The Open University, Walton Hall, Milton Keynes MK7 6AA.

If you are disabled

If you have a severe visual disability or restriction of mobility you may find some parts of the course difficult. There are no recordings of printed course material. You will be expected to attend the weekend school, and also to have access to a scientific library. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Study texts
Notes to accompany the cassettes

Cassettes
Three audio cassettes

You will need to buy

Set book
Details will be sent to you in the first course mailing.

You will also need

Audio cassette player
Because the main part of this course is the self-directed literature project, you must have access to a scientific library that has chemistry and life sciences journals as well as abstracting services.

Residential school

The weekend school is an essential part of the course. It will be held at Walton Hall in late March or early April. The fee for the school (£139.50 in 1996) is not included in the course fee.

Revision weekend
A revision weekend school for this and other chemistry courses is usually held shortly before the examination. This is not formally part of the course and a fee is charged for attendance. For more information please ask the S442 Course Manager (at the address given in *Advice to applicants*).

Assessment

There are three tutor-marked assignments (the third is a dissertation) and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. It is required for admission to the Royal Society of Chemistry at graduate or licentiate level, and is also recognized by the Institute of Hospital Engineering. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

For the future

After 1997 S442 will be presented again in 1999, when it will be revised and brought up to date.

Study Pack

Into science

Into science is a set of twelve introductory modules for those who are preparing to take science courses at degree level. It introduces scientific and mathematical concepts and skills through topics of everyday interest such as increase in population, how plants grow, contamination of drinking water, and global warming. The modules gradually increase in length, the first taking about three hours and the last about twelve. There are exercises and questions to work through, and two computer-marked assignments. If you register for the science foundation course we will send you *Into science* free before the course begins.

Into science contains an introduction and guide, twelve study units, a workbook, an assignment book and two computer-marked assignments (with pre-paid stationery to send them in).

Order code S510S
Fee £36
Discount scheme – see page 1

Technology Faculty

Do you want to understand how technology is affecting our lives and how we can make best use of it? Are you interested in controlling environmental pollution, using information technology or designing and managing technology? Do you want to start or further a career as a professional engineer, designer or manager working with new technologies? Do you need better communication and problem-solving skills for the computer age?

Undergraduate-level courses from the Technology Faculty, alongside those from other faculties, will provide much of what you need. The Technology Faculty offers courses that enable you to:

- Understand technological developments and the assumptions that underlie them, their implications and the surrounding issues.
- Develop and practise your skills in particular aspects of technology and its design and management.
- Broaden and deepen your knowledge of engineering principles and concepts.
- Learn through the use of computer-based technology as well as print and audio-visual methods.

By selecting an appropriate combination of the Faculty's courses you can construct degrees that will satisfy the educational requirements of many professional engineering institutions, allow you to broaden any technical qualifications you already have into areas of design, technology management and information technology, or combine with courses from other faculties to enhance your understanding of technology at the end of the twentieth century. Some technology-based areas in which you could build up your degree are described in this overview.

In the light of your long-term aims and your educational experience you will need to consider whether you should take one or more Level 1 courses or start your studies at a higher level. Most Level 2 and Level 3 courses expect you to bring certain knowledge and skills to them, so please take careful note of the advice in the course descriptions.

LEVELS OF STUDY

Level 1

The foundation course, T102 *Living with technology*, gives a broad introduction to the issues and effects of technology in the home, at work and in the environment. It also equips you with the skills to analyse and quantify these effects through the study of some technical subjects, the use of computers and computing skills (including access to communications and information through electronic networks), and report-writing. The course is also designed to develop your study skills along with literacy and numeracy skills. The choice of topics is deliberately broad, reflecting important topics such as sustainable use of resources, development of information highways, and innovation in the design and implementation of technology at home and at work.

If you want to move on into some of the areas described below you may need to do further study at Level 1 in particular the introductory mathematics courses MU120 *Open mathematics* (described on page 5) and MST121 *Using mathematics* (page 5).

Level 2 and Level 3

Our higher-level courses continue to teach their particular topics in the context of practical problems that arise in organizational or industrial contexts. In this way they provide a self-contained study as well as a stepping-stone to other courses. You can either choose courses that contribute to one of the cross-disciplinary themes such as environmental management or technological design, or concentrate on professional development in engineering disciplines such as electronics, mechanical engineering and materials. Whichever direction you prefer, look carefully at the advice in the course descriptions and be sure that you are suitably prepared for any course you consider.

Project course

T401 *Technology project* enables you to bring all you have learnt to bear on a substantial practical task. If you want membership of one of the professional engineering institutions (see below) you will have to complete an honours degree that includes this supervised project course. The course description on page 52 explains the entry requirements and will help you to judge whether the project is a suitable choice for you.

TECHNOLOGY-BASED AREAS OF STUDY

Environmental management

If you have an interest in environmental issues the Faculty offers several courses that can be combined with U courses and courses from the Science and Social Science Faculties.

U206 *Environment*, an obvious choice after either the technology (or science) foundation course, could be followed by ST240 *Our chemical environment* before two professionally oriented courses, T237 *Environmental control and public health* and T303 *Environmental monitoring, modelling and control*. (U206 is described on page 44, ST240 on page 27.)

If you are interested in 'green design' and related consumer issues, you could build a degree round T102 *Living with technology*, T247 *Working with systems*, T204 *Design: principles and practice*, T265 *Renewable energy* and T303 *Innovation: design, environment and strategy*.

Courses from other faculties with an environmental theme are S269 *Earth and life*, S328 *Ecology* and S330 *Oceanography* (pages 24, and 30). There are also two diplomas that you could obtain, either on their own or on your way to a degree.

Diploma in Pollution Control
For this diploma you need to complete two technology courses:
T237 *Environmental control and public health*
T303 *Environmental monitoring, modelling and control*
and one science course chosen from:
ST240 *Our chemical environment*
S268 *Physical resources and environment*
S280 *Science matters*
The science courses are described on pages 27, 23 and 25.

Diploma in Environment and Development
This diploma offers a wide appreciation of global issues. It consists of two courses:
U206 *Environment*
U208 *Third World development*
These coures are described on pages 44 and 45. You could go further in this area by following the diploma with DT210 *Environmental policy in an international context* (page 44).

Information technology

The Technology Faculty's courses related to information technology combine well with those offered by the Mathematics and Computing Faculty in the area of computing and computers. Our foundation course introduces information technology through the use of integrated general-purpose software and of electronic networks for communication and for access to information sources. This is developed in T293 *Communicating technology*. If you go on to T247 *Working with systems* you will expand your experience of using the software for modelling purposes, while THD204 *Information technology and society* offers insights into how information technology is affecting the workplace, education and the home. It will also give you experience of working with various electronic information sources including CD-ROMs. If you are interested in the application of information technology to management problems, T301 *Complexity, management and change: applying a systems approach* includes a project in which you can develop and practise your skills.

For the computing side of information technology, the Level 3 courses T396 *Artificial intelligence for technology* and T395 *Mechatronics*

designing intelligent machines are a good choice together with some of the computing courses from the Mathematics and Computing Faculty, such as M205 *Fundamentals of computing* (page 6), M353 *Programming and programming languages* (page 12), M355 *Topics in software engineering* (page 12) and M357 *Data models and databases* (page 12).

Management of technology

If your career has taken you into posts with increased responsibilities for decision-making, you might find it particularly valuable to include courses that widen your understanding of organizational systems and of the processes of innovation and invention, and that teach you analytical and problem-solving techniques. You might want to combine these with courses to expand your technical knowledge in appropriate areas.

T247 *Working with systems*, T245 *Managing in organizations*, T301 *Complexity, management and change: applying a systems approach*, T204 *Design: principles and practice* and T302 *Innovation: design, environment and strategy* are the core of the management of technology area. They could be combined with courses from other disciplines in technology, with economics courses from the Social Science Faculty such as D216 *Economics and changing economies* and D345 *Economics and government policy*, or with courses from our Business School.

Technological design

Design is a fundamental part of all technological activities. We offer both broad courses such as T204 *Design: principles and practice* and T302 *Innovation: design, environment and strategy* for those of you who have an interest in design as users, consumers, managers, teachers or practitioners, and specialized courses such as T363 *Computer-aided design*, T395 *Mechatronics: designing intelligent machines* and MT365 *Graphs, networks and design* for those of you working in engineering design or allied fields. Such courses are readily complemented by other technology courses in the areas of electronics, mechanical engineering and materials.

Professional development in engineering

The Faculty has many courses that are directly relevant to both practising and budding engineers. Indeed many professional institutions in engineering and other disciplines will accept certain sets of Open University courses as fulfilling most of the educational requirements for membership (see Professional Recognition Leaflets 3.3 and 3.4, available from your Regional Centre). Our students are most usually interested in the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Institute of Materials.

If you have not studied technological subjects beyond T102, courses such as T247 *Working with systems*, T293 *Communicating technology* or T204 *Design: principles and practice* will give you a smoother transition to further studies at Level 2 than a direct step into an engineering mechanics, materials or electronics course. If you already have an ONC or HNC, or you have taken a second Level 1 course in science or mathematics, the transition to courses such as T202 *Analogue and digital electronics*, T203 *Materials: engineering and science*, T235 *Engineering mechanics: solids*, T236 *Introduction to thermofluid mechanics* and MST204 *Mathematical models and methods* may not present you with too many problems, but be sure that you have covered the necessary topics in preparation. If you have any doubt, consult someone who is familiar with the courses: a counsellor, regional adviser, course manager or staff tutor.

For membership of a professional engineering institution you will need 480 points, with 180 at Level 3 rather than the minimum 120 for an honours degree. You must also include T401 *Technology project*.

Postgraduate study

If you already have or are about to complete a degree you might want to go on to postgraduate study. The University offers diplomas and a master's degree in Computing for Commerce and Industry and in Manufacturing: Management and Technology. There is also an MBA (Technology Management), which is particularly appropriate if you are engaged in the management of technology at middle or senior management level.

New developments

The use of computers and information technology as part of our courses will expand considerably, and electronic communication is likely to be a standard feature of most of them by 1998.

We have just received approval for a new first degree in engineering (MEng) that will be a better route to professional recognition, fitting in with the Engineering Council's ideas as expressed in their paper *Competence and Commitment*. We may be able to offer this award in 1997, but many details are still to be negotiated. We will tell you more when these have been confirmed.

SUGGESTED ROUTES IN TECHNOLOGY

LEVEL 1	page	LEVEL 2	page	LEVEL 3	page
Information technology					
T102 *Living with technology*	37	THD204 *Information technology and society*	43	T396 *Artificial intelligence for technology*	52
MU120 *Open mathematics*	5	T247 *Working with systems*	42	T401 *Technology project*	52
MST121 *Using mathematics*	5	T293 *Communicating technology*	43	T301 *Complexity, management and change: applying a systems approach*	45
				T354 *Inside electronic devices: engineering of information technology*	50
				T395 *Mechatronics: designing intelligent machines*	51
Environmental management					
T102 *Living with technology*	37	T237 *Environmental control and public health*	41	T303 *Environmental monitoring, modelling and control*	47
S102 *Science: a foundation course*	20	T247 *Working with systems*	42	T302 *Innovation: design environment and strategy*	46
MU120 *Open mathematics*	5	T265 *Renewable energy*	42	T401 *Technology project*	52
MST121 *Using mathematics*	5	ST240 *Our chemical environment*	27	T301 *Complexity management and change: applying a systems approach*	45
		DT210 *Environmental policy in an international context*	44		
		U206 *Environment*	44		
Management of technology					
T102 *Living with technology*	37	T245 *Managing in organizations*	41	T301 *Complexity, management and change: applying a systems approach*	45
		T247 *Working with systems*	42		
		T204 *Design: principles and practice*	39	T302 *Innovation: design environment and strategy*	46
		THD204 *Information technology and society*	43	T401 *Technology project*	52
Technological design					
T102 *Living with technology*	37	T204 *Design: principles and practice*	39	T302 *Innovation: design environment and strategy*	46
MU120 *Open mathematics*	5	T247 *Working with systems*	42	T363 *Computer-aided design*	51
MST121 *Using mathematics*	5	T293 *Communicating technology*	43	T395 *Mechatronics: designing intelligent machines*	51
				MT365 *Graphs, networks and design*	15
				T401 *Technology project*	52
				T323 *Logic design*	48
Professional development in engineering					
T102 *Living with technology*	37	T202 *Analogue and digital electronics*	38	T322 *Digital telecommunications*	47
MU120 *Open mathematics*	5	T203 *Materials: engineering and science*	38	T323 *Logic design*	48
MST121 *Using mathematics*	5	T204 *Design: principles and practice*	39	T331 *Engineering mechanics: solids and fluids*	48
		T223 *Microprocessor-based computers*	39	T333 *Heat transfer: principles and applications*	49
		T235 *Engineering mechanics: solids*	40	T353 *Failure of stressed materials*	49
		T236 *Introduction to thermofluid mechanics*	40	T354 *Inside electronic devices: engineering of information technology*	50
		MST204 *Mathematical models and methods*	10	T355 *Manufacturing technology*	50
				T395 *Mechatronics: designing intelligent machines*	51
				T396 *Artificial intelligence for technology*	52
				T401 *Technology project*	52
				MST322 *Mathematical methods and fluid dynamics*	14

RELATED COURSES IN TECHNOLOGY

Environmental management

T102 Living with technology 37
MU120 Open mathematics 5
MST121 Using mathematics 5
S102 Science: a foundation course 20
T237 Environmental control and public health 41
T247 Working with systems 42
T265 Renewable energy 42
DT210 Environmental policy in an international context 44
S268 Physical resources and environment 23
S269 Earth and life 24
S280 Science matters 25
U206 Environment 44
U208 Third World development 45
ST240 Our chemical environment 27
T301 Complexity, management and change: applying a systems approach 45
T302 Innovation: design, environment and strategy 46
T303 Environmental monitoring, modelling and control 47
T401 Technology project 52
S328 Ecology 30
S330 Oceanography 30

T247, T303, S268, S280 and ST240 can contribute to the Diploma in Pollution Control. D206 and U208 together make up the Diploma in Environmental Development.

Information technology

T102 Living with technology 37
MU120 Open mathematics 5
MST121 Using mathematics 5
T247 Working with systems 42
T293 Communicating technology 43
THD204 Information technology and society 43
M205 Fundamentals of computing 6
T301 Complexity, management and change: applying a systems approach 45
T354 Inside electronic devices: engineering of information technology 50
T395 Mechatronics: designing intelligent machines 51
T396 Artificial intelligence for technology 52
T401 Technology project 52
M353 Programming and programming languages 12
M355 Topics in software engineering 12
M357 Data models and databases 12

Management of technology

T102 Living with technology 37
T204 Design: principles and practice 39
T245 Managing in organizations 41
T247 Working with systems 42
THD204 Information technology and society 43
D216 Economics and changing economies *
T301 Complexity, management and change: applying a systems approach 45
T302 Innovation: design, environment and strategy 46
T401 Technology project 52
D345 Economics and government policy *

Technological design

T102 Living with technology 37
MU120 Open mathematics 5
MST121 Using mathematics 5
T204 Design: principles and practice 39
T247 Working with systems 42
T293 Communicating technology 43
T302 Innovation: design, environment and strategy 46
T323 Logic design 48
T363 Computer-aided design 51
T395 Mechatronics: designing intelligent machines 51
T401 Technology project 52
MT365 Graphs, networks and design 15

Professional development in engineering

T102 Living with technology 37
MU120 Open mathematics 5
MST121 Using mathematics 5
S102 Science: a foundation course 20
T202 Analogue and digital electronics 38
T203 Materials: engineering and science 38
T204 Design: principles and practice 39
T223 Microprocessor-based computers 39
T235 Engineering mechanics: solids 40
T236 Introduction to thermofluid mechanics 40
T247 Working with systems 42
MST204 Mathematical models and methods 10
T322 Digital telecommunications 47
T323 Logic design 48
T331 Engineering mechanics: solids and fluids 48
T333 Heat transfer: principles and applications 49
T353 Failure of stressed materials 49
T354 Inside electronic devices: engineering of information technology 50
T355 Manufacturing technology 50
T395 Mechatronics: designing intelligent machines 51
T396 Artificial intelligence for technology 52
T401 Technology project 52
MST322 Mathematical methods and fluid dynamics 14

*Full details in the *Social, Educational & Business Studies guide*.

T102

LIVING WITH TECHNOLOGY: A FOUNDATION COURSE

This is a 60-point course at Level 1, with a one-week residential school.
It requires a personal computer.

The course

Living with technology – it's almost impossible to imagine living *without* technology, but we also have to live with the consequences of our technological way of life. We have come to rely on electricity, manufactured goods, transport systems, telephones and so on, and with the coming of the 'information superhighway' we stand on the brink of another wave of developments that will change our lives. But we can all see some of the problems that technology brings: pollution, global warming and the mixed benefits of the information technology revolution. No one is immune to these. Even something as apparently natural as food production is a highly technological process with its own problems and difficulties. So what is technology, and what do technologists do? This course will help you to understand these questions, and to respond to them in an informed way. It is not an introduction to science and engineering, although you will find many scientific and engineering ideas in the course. Rather, it takes a detailed look at controversial current issues and examines the technological questions that arise from them. The issues are all concerned with basic human needs for shelter, communication, energy, resources, food and health. By studying these you will learn about the tools technologists use for design, analysis and decision-making and you will gain some of these skills for yourself. The course will also increase your ability to learn from different media and to manage your learning time effectively, and you will gain general skills that are applicable to a wide range of work and social activities. By the end of the course you will be able to:

- Read critically, analyse and summarize complex written material.
- Use a personal computer for learning, writing, calculating, graphics, electronic mail and conferencing.
- Plan and write a structured report on a given topic.
- Develop and apply simple mathematical models.

You will learn scientific and engineering skills including:

- How to use a systems approach, symbolic and mathematical models, design and decision-making methods, simple algebra and statistics, engineering properties of materials, resources and reserves, information systems.
- Basic scientific concepts such as energy conversion, mass, force, chemical bonding and reactions, properties of living organisms.

The course introduces the personal computer as a working tool. You will learn to use it as a word-processor, a spreadsheet calculator, a database, to produce graphics and as a gateway to electronic communications: you will have the opportunity to take part in computer conferences on course topics, and you may be able to correspond with your tutor by electronic mail. You will *not* learn about programming. The appropriate teaching software is supplied as part of the course material.

The course is divided into six blocks of work, each centred on an issue of current concern. Each issue is developed in a 'mainstream' text, and the knowledge and skills you need to understand it are explained in 'tributary' texts. Each block (except Block 5) also has a numeracy tributary and associated computer-assisted learning material to develop the necessary mathematical skills.

The first block, *Home*, is concerned with designing an efficient house that is a satisfactory compromise between capital and running costs. There are tributaries on heat and structures, and the computing work builds up your skills in using the computer.

Communication looks at the increasing role played by information technology in everyday life, and asks whether computers are changing the way we communicate. You will use your computer to send electronic mail messages over the telephone network to your tutor and to other students, and to retrieve information electronically from other computers. You will develop skills in producing spreadsheets, and there is a tributary on information technology.

Energy is about the considerations that determine whether a particular technology, in this case district heating, is adopted or not. There are tributaries on energy conversion and electricity. The computing work develops the use of spreadsheets for financial and other modelling tasks.

Resources asks 'Are we using resources effectively?' It includes a tributary on materials (which includes chemistry), and introduces the use of databases.

Food asks 'Can current UK agricultural practices be sustained for the next thirty years?' There is a tributary on biology, and you use graphics software on the computer with data from the agricultural census.

Health explores the beneficial and harmful effects of technology on human health, and ways of assessing and minimizing health risks. There are tributaries on biology and on summarizing and interpreting data.

The course culminates in an assignment that asks you to present a 2500-word structured report on a given topic, based on what you have learnt from the course.

Advice to applicants

You are not expected to have any scientific or technical knowledge, but you must be able to add, subtract, multiply and divide whole numbers; read text of a style and complexity characteristic of a broadsheet newspaper or professional magazine; correctly interpret simple maps, plans, line graphs and tabulated data.

Preparatory work

If you register for the course, a preparatory package will be sent to you before it begins.

If you are disabled

Please get in touch either with Dr A. Armstrong, Technology Staff Tutor, The Open University in Wales, 24 Cathedral Road, Cardiff CF1 9SA, or with the Office for Students with Disabilities, The Open University, Walton Hall, Milton Keynes MK7 6AR, to discuss your requirements. Printed course materials may be available on audio cassette, and there may be transcripts of the course broadcasts and cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Preparatory material
Introductory supplement
Six blocks
Residential school handbook
Supplementary materials including study guides

Broadcasts and cassettes
Eight television programmes
Six audio cassettes

Software
Teaching software is supplied

You will need

Television
Audio cassette player
Computer and modem as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre). We will send you more information if you register for the course.

Residential school

The one-week summer school offers a programme of activities in laboratories and classrooms, and a series of evening tutorials on aspects of the course. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are six tutor-marked assignments, six computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T102 the rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated E, which means that it is equally appropriate to either.

Related courses
Because the subject matter of T102 overlaps with the discontinued courses T101, ET217, PET271 and PS91, you can count only one of the five towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by many engineering institutions and by the Institution of Analysts and Programmers, and is included in the Open University degree profile recommended by the police training authorities. You can find out more in our Recognition Information leaflets:
3.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporations*
3.2 *Membership of professional bodies: the Royal Town Planning Institute*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

For the future

T102 will be presented for the last time in 1997.

T103
ANALOGUE AND DIGITAL ELECTRONICS

This is a 60-point course at Level 2, with a one-week residential school.
It requires a personal computer.

The course

This course will give you a thorough understanding of electronic principles, components, circuits and systems, and develop the fundamental theoretical and practical skills you need to carry out engineering analysis and design. A wide variety of topics is treated in enough detail to give you a sound foundation in this rapidly developing area. The course is essential preparation for the Open University's more advanced courses in electronics and so is an important course if you are specializing in the area. It is also suitable for students in other disciplines who want a good working knowledge of electronics. The treatment is by no means superficial and you must make sure that you have the necessary mathematical and scientific background (see *Advice to applicants*).
The central theme of the course is the analysis and design of analogue and digital circuits. To develop your understanding of these circuits, the first part of the course teaches the principles of the electronic components that form the basic building blocks, and also the application of appropriate mathematical methods of modelling components and circuits. The second part of the course looks at aspects of more complicated circuits and systems.
Practical skills in electronics are developed with the home kit, which includes a combined signal generator and oscilloscope, and at the residential school, where you will use a wider range of equipment and take part in more complicated projects than can be attempted at home.
Computers now play an important role in the design process, and an innovation in this course is the use of a computer-aided design package to help with circuit design. You will need the use of a computer for this.
The course covers AC circuit analysis, including step and frequency response; nodal analysis and Thévenin and Norton equivalent circuits; properties of amplifiers, feedback and operational amplifiers; transistors and the design of integrated circuits; principles of digital electronics, including combinational and sequential logic circuits; digital-to-analogue and analogue-to-digital converters. These principles are then used to study more complicated circuits and systems.

Advice to applicants

You must have mathematics, physics and/or electrical and electronic principles to at least A-level standard.

How you are assessed

Practical experiments and computer work at home and at the residential school are an important part of the course. For the practical work you need to identify small components that are distinguished by combinations of narrow bands of colour or small letters, and to place them on circuit boards; you also need to take readings from and make adjustments to a combined signal generator and oscilloscope. Printed course materials are available on audio cassette. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Nine study texts
Home computing book
Home experiment book
Glossary

Software
Computer software is supplied on 3.5-inch or 5.25-inch disks. You will be asked which you need.

Home kit
You will be lent apparatus and components with which to carry out electronic experiments at home.

Outside the UK
There are restrictions on sending the home kit to Slovenia, so you will be able to take the course there only if you have adequate access to appropriate electronic equipment. You can get more information from the Open University, North Region, Kings Manor, Newcastle-upon-Tyne, NE1 6PA, telephone 0191 284 1611.

You will need

Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)
Audio cassette player (for use with the home kit)
Scientific calculator
Multimeter
Dry, flat surface measuring at least 1m x 1m to work on

Residential school

The programme at the one-week summer school consists of laboratory experiments and projects, lectures and tutorials. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are seven tutor-marked assignments, six computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T202 this rule can apply to two tutor-marked assignments and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated S, which means that it can weight your degree towards a BSc.

Related courses
Because the subject matter of T202 overlaps with the discontinued courses T283 and TS282, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
You can get these from your Regional Centre.

For the future

T202 will be presented for the last time in 1999.

T202
MATERIALS: ENGINEERING AND SCIENCE

This is a 60-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

An understanding of engineering materials, how they behave and how they can be manipulated underlies the whole of technology and is the key to making successful products, from sewing needles to bridges. Choosing materials for a product depends on a combination of technical and commercial considerations but above all, to perform satisfactorily 'in service', the materials must have the required properties such as strength, electrical conductivity, transparency or resistance to corrosion. Of course failures do occur, from the mundane breaking of a plastic fork or the MOT failure of a rusting car to the dramatic space-shuttle disaster. These usually happen because the wrong material was used or the material was used wrongly.
Ultimately, the properties of a material are determined by its constitution and internal structure: the atoms or molecules it contains, the bonding between them, how they are arranged and so on. In turn, the structure of a material is strongly influenced by its processing history: whether, for example, it has been cast from a liquid, pressed from a powder or moulded under pressure.
Scientific understanding of structure–property relations in materials and how processing influences them has made enormous progress in the last fifty years, and now provides a firm basis for selecting materials and production routes from a wide choice. This knowledge has been the key to the development of new and improved materials and processes, and the course introduces it by exploring the relationships between structure, properties and processes for a wide variety of materials including plastics, metals, ceramics, glasses, composites, semiconductors and some natural materials.
For this exploration you will need a scientific modelling 'toolkit'. The first part of the course, *Science for materials*, is devoted to developing the scientific modelling toolkit in the context of materials, building on elementary scientific concepts. Some basic mathematics, an intrinsic part of the language of science and technology, is also introduced here. The topics covered are:
Materials and mechanics
Materials and thermal energy
Materials and chemistry
Materials, electricity and magnetism
Materials and radiation
The second part of the course, *Materials principles and practice*, considers how products are made. The different properties of different materials determine not just the behaviour of products but also which production processes are feasible. Properties, in turn, can be modified by the production process. Understanding how properties can be manipulated requires the application of scientific modelling, and we approach this by modelling the state of matter as a balance between the tendencies of atoms to stick together by chemical bonding and to vibrate apart through thermal energy. This leads into property modification through control of microstructure by thermal, mechanical and chemical means. The topics in this section are:
Products, properties, processes and principles
The nature of materials
An atomic view of solids
Temperature as an agent of change
Controlling the mix
Mechanical properties for processing and use
Chemical properties for processing and use
The last part of the course, *Structural materials*, illustrates the breadth and diversity of materials that have been developed to meet load-bearing applications. The interrelationships between structure, properties, processing and function are emphasized, and are exemplified by many real products that also develop the theme of materials selection. These include not only conventional engineering materials such as steels, plastics and ceramics, but also high-performance materials such as advanced composites and high-temperature alloys, on the one hand, and more everyday materials such as textiles, paper and timber on the other. The need to balance good mechanical performance with requirements such as environmental resistance, cost, ease of processing and mass of a product is underlined by many of the examples. The topics are:
Materials and mechanics
Non-ferrous metals
Iron and steel
Ceramics and glasses
Polymeric materials
Fibres and fibre assemblies
Composite materials
Cement, concrete and reinforced concrete
Selection of materials: a case study

Advice to applicants

This course is designed to lead directly from the University's technology foundation course, T102 *Living with technology*, into the more specialized study of materials science and technology. In particular it relies on the scientific and mathematical skills taught in the foundation course. If you have taken T102, and found the maths and science particularly difficult and performed poorly in those areas, you are likely to have similar problems with T203. If you have not taken T102, your Regional Centre will be able to tell you where you can see reference copies so that you can get an idea of the starting point of *Materials: engineering and science*, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. If you have passed S102, the science foundation course, you will find that a more than adequate preparation for T203.

If you are disabled

The course makes extensive use of complex diagrams, graphs and microstructures in the texts and there are no recordings of printed course materials, but there are transcripts of the audio-visual materials. The residential school is largely based on practical laboratory work. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts
Audio and video booklets
Three study guides
Course guide and other supplementary notes

Broadcasts and cassettes
Eight television programmes
Four video cassettes
Three audio cassettes

You will need

Television
Audio cassette player
Video cassette player (VHS)
Scientific calculator

Residential school

The course includes a one-week summer school consisting mainly of practical work. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are six tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T203 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of T203 overlaps with the discontinued courses T201, T252, T253, T254, T255 and TS251, you can count only one of the seven towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It can count towards the qualifications of many professional engineering institutions and the Royal Society of Chemistry, and it is also one of the approved courses for the Merchant Navy Extra Master's Certificate. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporation*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

T204

DESIGN: PRINCIPLES AND PRACTICE

This is a 60-point course at Level 2.
It has no residential school and requires no computing equipment.

The course

This course should make the subject of design relevant, accessible and interesting to technologists and non-technologists alike. People encounter the products of design every day, yet often have a partial or haphazard understanding of what goes into the design and making of them. Our intention is not to train you to become a professional designer but, by teaching you something about the design processes that generate particular products and giving you practice in basic design skills, to develop your understanding of what it is like to be a designer. If you are already a practising designer, the course will give you a broad but structured understanding of design principles. The main aims of the course are:

- To develop your design *awareness* and foster an analytical judgement of designed objects by helping you to understand how decisions are made about the design of artefacts, the influences that contribute to these decisions, and the nature of the design process.
- To develop your understanding of design *principles* applicable across a variety of professional practices such as product design, engineering and architecture
- To develop your design *skills* by giving instruction, examples and experience in the use of basic techniques such as drawing, modelling, creative thinking.

After a general introduction that examines the nature and activities of design, five sections highlight each of the main stages of product development from initial formulation of the design task through conceptual and layout design to detailed development for manufacture. A variety of products is used to illustrate the principles and practice of design, and you will be able to apply what you have learnt in a series of guided design exercises at each stage.

An introduction to design
This sets the framework for the course by considering various influences on design, including the motivations of those involved in the design process. A selection of chairs is examined to illustrate important points about the nature of design, design activities and the design process, and this leads you into designing a chair yourself. Visual thinking skills are encouraged through simple drawing exercises.

Product planning and the design brief: the evaluation and specification of consumer products
The exploration, planning and briefing phase is illustrated by domestic appliances such as cookers and audio equipment. The skills developed include exploring a design problem (including evaluation of a product, technical and market forecasting), setting objectives and developing a design brief.

Creativity and conceptual design: the invention and evolution of bicycles
Here we concentrate on the creative aspects of designing, especially in the inventive and early conceptual phase. Bicycles and their components are the main source of examples to illustrate the relationship between invention and design and the nature of the creative process. The skills taught include generating alternative solution ideas using both conventional approaches and idea generation techniques.

Geometry and configuration in design: the form and performance of houses
This looks at the central activities in the design process that are concerned with devising, manipulating and specifying the geometrical forms of designed objects. Examples are drawn mostly from the design of small houses, but there are also links with other areas of engineering and product design. A second theme is the role of drawings and models in design. The skills include generating alternative configurations; using simple geometrical and mathematical models; reading and making drawings.

Product development and manufacture: the design and engineering of cars
This section is about the later phases of design, moving from concept and embodiment to detail, with particular attention to design in relation to practical considerations such as choice and processing of materials, manufacture, assembly and testing. Taking cars as the example, we look at the knowledge and skills of engineering designers and the skills used in manufacture. Earlier parts of the course asked who uses design, or why things are as they are, or what form they take. This part looks at how design ideas are realized. We move from the generation of design concepts to making the concepts work, and there are materials, samples and facsimile drawings to study.

A review of design
The last section builds on the idea, developed throughout the course, that designers do not work in isolation. Design is affected by many things, such as changes in the market, new materials, increasing technical sophistication and economic and social changes. The nature of the organizations for which designers work is also important. Using textiles as the main source of examples, we identify some salient characteristics of current patterns of economic and other changes and consider how they might modify approaches to design.

Guided design exercises
As part of your wider understanding of what design involves, it is important for you to learn something about what it feels like to design. We have devised a series of exercises that enable you to practise some of the skills commonly used by designers. These skills include critical observation, the ability to read drawings, creative problem-solving, the cultivation of inventiveness and communication of design ideas through various kinds of drawing, models and written explanation.
The exercises start, in the second section of the course, by asking you to evaluate the design of a consumer product from a user's point of view, then make suggestions for improvements and write a specification for changing a particular feature. In the next section the exercise is concerned with conceptual design. It asks you to examine the context in which the product will be used, generate ideas for design solutions to meet its requirements, and narrow them down to a description in words and drawings of your most promising idea.
The exercise in the fourth section concerns three-dimensional spatial design. You are asked to examine systematically the possible configurations of given components into a workable product, then choose one or two of the layout designs and develop them more fully through drawings and brief notes. You will make a comparative evaluation of these designs and produce a short report on the best one to take on to the detailed design stage. The last exercise is about design for manufacture. You are asked to examine and describe the main components of a domestic product and make a critique of their design from a manufacturing point of view. You will then select one detail to redesign, bearing in mind appropriate materials and ease of manufacture, and present your new design features in drawings.
Each exercise is supported by descriptions in the texts of similar exercises carried out by professional designers, by coaching in the design skills and by practical notes. The last assignment gives you the chance to bring all these exercises together in a single design project.

Advice to applicants

We expect that the course will be of interest to non-technologists as well as to those taking courses in technology. If you are studying materials, mechanics or electronics you will benefit from gaining a design perspective on your own area. If you are already a designer, the course will broaden your experience by offering comparisons with other fields of design and showing the relationships between design principles and practices.
You are expected to have basic literacy skills, but beyond that nothing more specific than a curiosity about objects, why they are as they are, and how they might be different and even better for our diverse needs. The course does not assume that you can already design, or even draw competently. You will be taught all the concepts and skills that you need, but if you already have some skills you will be able to develop them further.

If you are disabled

You may find you need help with the practical work, and there are no recordings of printed materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Course guide
Notes explaining how to use the home kit
Drawing work book: graded exercises to give you basic skills in various kinds of drawing used by designers
Six main study texts
Study guides to accompany the audio and video cassettes
Supplementary information booklets on industrial manufacturing and computers in design
Notes to take you through the guided design exercises

Home kit
You will be lent a kit that contains industrial samples, drawing board, compasses and so on for use in your drawing.

Cassettes
Six programmes on video cassette
Four audio cassettes

You will need

Television
Video cassette player (VHS)
Audio cassette player

Assessment

There are seven tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T204 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of T204 overlaps with the discontinued courses T262, T263 and T264, you can count only one of the four towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*

You can get these from your Regional Centre.

T223

MICROPROCESSOR-BASED COMPUTERS

This is a 30-point course at Level 2, with no residential school.
It requires a personal computer.

The course

Desktop and portable computers are now used for many tasks, but what is going on inside them as they perform these tasks? Many products are described as 'microprocessor-based', but what is the role of a microprocessor in such a product? Computer programs are written to get computers to perform specific tasks, but how does a computer make use of a program? These are just some of the questions to do with microprocessor-based computers that this course will enable you to answer. It will give you an introduction to the components and operation of both general-purpose and dedicated microprocessor-based computers, that is, both computers like those used in the Open University's computing courses and computers used in small dedicated control applications such as washing machines or central-heating controllers. Although the emphasis of the course is on the components and operation of the computers, some simple programming ideas are included and in particular the C programming language is introduced.
This is not simply a computer awareness course; it goes beyond an introductory level in its explanation of the operation of computers. By the end of it you should be able to understand and explain the general principles and operation of microprocessor-based computers, both hardware and software. You will also have some important additional skills such as being able to

- Read and understand, in general terms, technical literature on microprocessor-based computers and their components.
- Use a program development environment (Turbo C) that includes a screen-based editor.
- Read and understand the function of simple programs in the C language and modify them.

Home computing is used extensively throughout the course to reinforce ideas introduced in the texts. A temperature-measuring system is used as an example application to demonstrate many of the principles. This application, which uses a small experiment kit together with your personal computer, is studied in increasing detail as the course progresses and you will make small enhancements to its operations to reinforce your understanding of the principles.

The course begins with a brief history of computers, a survey of applications and an introduction to the main components of a microprocessor-based computer system. The temperature-measuring system is also introduced. The program development process for computers is outlined and the C programming language is introduced. Then we examine methods of representing numbers and physical quantities in a form suitable for a computer, and study the basic operation of a simple computer processor. The advantages and disadvantages of using different programming languages are also discussed.

A substantial part of the course is devoted to input and output (data transfers), often the most complicated part of a computer system. Four basic methods of initiating and controlling data transfers are explained and the ways in which the computer's operating system can assist with data transfers are examined.

Microcontrollers and their incorporation into small control applications are examined briefly, and the computer in the experiment kit (which is part of the temperature-measurement system) is used as one of the example control applications.

There are practical activities associated with each of these parts of the course. The last part introduces some areas that are at the centre of current development activities, and there are some supplementary articles on topics covered by the course.

Advice to applicants

You need have no knowledge of computers, although the course moves quickly beyond the introductory level and if you have little or no knowledge before you begin you can expect to take a little more time for your study. You will probably find the course easier if you are already familiar with using a computer, and in particular you will need a working knowledge of MS-DOS and GEM. There is an introductory practical book in the first course mailing that will give you this knowledge, but this work is additional to, rather than part of, study of the course.

Preparatory work

If you have no experience of using MS-DOS or GEM with the computer, you will need to work through the introductory practical book before the course begins.

If you are disabled

If you have severely impaired sight or manual dexterity you may have difficulty with the practical work (about a quarter of the workload), although all of it is carried out at home. The course may not be suitable if you are blind, but printed course material is available on audio cassette. Please ask your Regional Centre for our booklet *Meeting your Needs* if you haven't already got it.

Course materials

Printed material
Introductory practical book on MS-DOS and GEM
Six study texts
Five booklets giving details of the practical work
A reference manual with details of the Turbo C environment, parts of the C language needed for the course and a technical specification of the home kit
A reference card with details of the Turbo C editor commands and frequently used MS-DOS commands
Course guide
Articles on topics in the course
Course index

Home kit
You will be lent a small kit that performs temperature measurement and is connected to your computer through the serial port. A connecting lead and temperature probe are also supplied.

Outside the UK
Because of restrictions on the kit this course is available only in Germany, Gibraltar, the Republic of Ireland, Luxembourg, the Netherlands and Switzerland.

Software
All the software you need except MS-DOS will be supplied, including a reduced version of the Turbo C compiler and environment. Software can be supplied on $3^{1}/_{2}$-inch or $5^{1}/_{4}$-inch floppy disks.

You will need

Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre), with MS-DOS version 2.1 or higher. Computers that require any sort of emulator to make them IBM-compatible are unlikely to be suitable for this course.

You will also need four RB14 batteries for the home kit.

Assessment

There are four tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T223 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

It is also part of the University's Diploma in Computing.

Related courses
Because the subject-matter of T223 overlaps with the discontinued courses TM221 and TM222, you can count only one of the three towards a BA, a BSc or a diploma.

Professional recognition
This course can in some circumstances help you to gain recognition from many of the professional engineering institutions including the Institution of Electrical Engineers, and from professional bodies such as the Institution of Analysts and Programmers and the British Computer Society. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.7 *Membership of professional bodies: the Institute of Acoustics*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

For the future

T223 will be presented for the last time in 1997.

T223

ENGINEERING MECHANICS: SOLIDS

This is a 30-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This is a mainstream engineering course that teaches the basic methods of analysis used by engineers in the design of products and systems, concentrating on solid bodies. Examples are drawn from many areas including the aerospace, aeronautical, automotive, building and railway industries, together with more everyday domestic products.

The main subject areas are kinematics, statics, dynamics and stress analysis. Kinematics is the representation and analysis of motion and in this course you will concentrate on the motions of free bodies and mechanisms. In statics you will study forces in equilibrium, particularly in relation to stationary structures designed to carry various loads. In dynamics you will study forces not in equilibrium applied to bodies, resulting in accelerations including vibrating motion. In stress analysis you will study the design of components such as structural members to carry the various forces generated by the applied loads. The course ends with a case study of a real mechanical engineering system that brings together all the subject areas in one design. By the time you have completed the course you should be able to:

- Predict and analyse the positions, velocities and accelerations of free bodies and basic mechanisms by analysis and graphical methods.
- Design and analyse the performance of free bodies and structural components under the influence of applied loads.
- Determine forces required to produce or prevent various motions, including those resulting from situations such as bodies in collision.
- Model and analyse vibrating bodies subject to various input and output motions, forces and damping.

Advice to applicants

Engineering is both practical and theoretical. The theoretical aspects are of necessity mathematical and require reasonable competence in geometry, algebra and calculus. For example, you should be familiar with:

- Trigonometrical functions sine, cosine, tangent; properties of triangles; plotting or sketching graphs of functions of two variables (e.g. position against time).
- The principles of differential and integral calculus, particularly as they relate to graphs of functions (gradients, areas etc.).
- Manipulation and solution of linear and quadratic equations. Solution of differential equations from first principles is not required but an appreciation of first-order and second-order types would be an advantage.

The texts are frequently interspersed with examples and self-assessment questions that you must attempt if you are to benefit from the course. You cannot learn mechanics by reading only; you must expect to spend a lot of time in problem-solving.

If you are disabled

The course includes the interpretation and construction of a large number of diagrams, so it may be difficult unless you have the assistance of a skilled helper. There are no recordings of printed course material but there are transcripts of the audio-visual materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts
Television notes
Audio cassette notes

Broadcasts and cassettes
Eight television programmes
Two audio cassettes

You will need

Television (preferably colour)
Audio cassette player
Scientific calculator
A simple set of drawing instruments

Residential school

The one-week summer school gives you an opportunity to apply the analytical techniques to design problems. It takes you from a textbook environment to something much closer to an engineering environment, where engineering principles are used to design real products for a given performance. There are also tutorials and example classes. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments, eight computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T235 this rule can apply to one tutor-marked assignment and two computer-marked assignments. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of T235 overlaps with the discontinued courses T231 and T232, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Mechanical Engineers. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: the Institute of Acoustics*

You can get these from your Regional Centre.

For the future

This course will be available until 1999, and it may be revised and brought up to date after that.

T235

INTRODUCTION TO THERMOFLUID MECHANICS

This is a 30-point course at Level 2.
It has no residential school and requires no computing equipment.

The course

This course is an introduction to two important areas of study in the field of engineering mechanics: thermodynamics and fluid mechanics. It looks at the concept of energy, its fundamental laws and ways in which energy can be conserved and used more efficiently. It considers how energy conversion occurs through processes involving heating and working, and how fluids can be used to exert forces and do work. Throughout the course the principles and laws of engineering thermodynamics and fluid mechanics are emphasized in order to show how processes and systems can be modelled and analysed. A firm understanding of these few basic concepts will enable you to investigate many engineering applications of thermofluid phenomena.

The aims of the course are to teach the basic analytical methods of thermodynamics and fluid mechanics and to introduce the use of these methods in engineering design. By the end of it you should be able to:

- Apply thermodynamic and fluid modelling to real systems.
- Choose appropriate control volumes.
- Perform 'second law' thermodynamic analyses (entropy).
- Analyse gas and vapour power cycles

- Use first and second laws for flow processes.
- Describe basic fluid flow phenomena.
- Apply similarity analyses to fluid flows.
- Solve pressure problems in fluid statics.
- Apply energy analysis to fluid flows, including friction.

The course is taught in 'blocks' of work, each consisting of two or three texts and about half an hour of watching a video cassette. Some blocks also use audio cassettes.

Block 1
Introduction to fluids; the continuum model; fluid properties and fluid flow phenomena; the mass continuity equation; looking at fluids in motion, introduction to fluid flow with observation of fluid phenomena, laminar and turbulent flow.
Similarity analysis and dimensionless groups.
This text introduces a technique that is fundamental to physical modelling, and to the analysis of various fluid phenomena.
Video programme Modelling canals, fluid flow visualization

Block 2
Fluid density, viscosity, pressures.
Fluid statics, fluid kinematics.
Bernoulli's equation, internal flows; pipe flow.
Applications of Bernoulli's equation.
Video programme Bernoulli's equation

Block 3
Fluid momentum, and how the flow of a fluid can exert forces.
Hydraulic turbines – the design of turbines.
Video programme Momentum; fluid machines
Video programme Water turbines

Block 4
The first law of thermodynamics; modelling and energy analyses of thermofluid systems.
Energy and temperature, thermal energy, internal energy, energy conversion, energy transfer, properties and states, gas processes.
Video programme The hydraulic ram

Block 5
The second law of thermodynamics; availability and irreversibility; heat engines; the Carnot cycle; efficiency and coefficient of performance.
Availability energy and entropy.
Video programme Carnot and Stirling cycles
Audio cassette Property diagrams; the laws of thermodynamics

Block 6
The first and second laws of thermodynamics for flow processes; control volume analysis; steady-state energy balance; entropy balance; introduction to tables of thermodynamic properties.
Power cycles and power stations.
Video programme Inputs and outputs; thermo flow; vapour cycles
Audio cassette Properties of real fluids; using property tables
Video programme Vapour cycles
Audio cassette 'Perpetual motion' machines

If you are disabled

You will need to interpret, assimilate and construct diagrams, and to use tables extensively, so you may have difficulty in completing several parts of the course unless you have assistance.
There are no recordings of printed course material but there are transcripts of the audio-visual materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Six study texts
Formula booklet
Course guide
Two booklets of supplementary material

Cassettes
Two video cassettes
Two audio cassettes

You will need to buy

Set book
G. F. C. Rogers, Y. R. Mayhew *Thermodynamics and Transport Properties of Fluids (SI Unit.)*, 5th edition, Blackwell Publishers, £4.50 (1996 price)

You will also need

Television
Video cassette player (VHS)
Audio cassette player
Scientific calculator

Assessment

There are four tutor-marked assignments, seven computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T236 this rule can apply to one tutor-marked assignment and two computer-marked assignments. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of T236 overlaps with the discontinued courses T231 and T233, you can count only one of the three towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from professional bodies such as the Institute of Physics and many of the professional engineering institutions. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

T237

ENVIRONMENTAL CONTROL AND PUBLIC HEALTH

This is a 30-point course at Level 2.
It has no residential school and requires no computing equipment.

The course

This course will give you a basic understanding of natural resources (land, air and water) and how they fit together in a coherent whole, and of related environmental problems. It would complement study in many areas of science and technology such as engineering, environmental and urban management, resource planning, natural resources and environmental health. It lays the foundation for developing a career and keeping up to date in the environmental area.
Many students, expressing satisfaction with the material, have said that it has helped with their careers or career development. By the end of the course you should be able to:
- Define and describe pollution and pollutants.
- Explain the necessity for conservation of land, air and water resources and for keeping pollution to the minimum.
- Understand that no problem of pollution or resource management can be tackled without taking pollution conversion and amenity into consideration.
- Quantify and assess the nature and extent of pollution, its dangers and its effects on the physical environment.
- Outline the legislation, already in force and proposed, to do with pollution control and public health and the methods and difficulties of making it work.
- Describe and discuss methods of pollution identification, assessment, measurement and control available in the fields of land, air, water and noise pollution.
- Understand some of the techniques of epidemiological investigation of pollution and public health problems.
- Understand the significance of the environment as a whole in any planning, industrial or technological context.
- Read, interpret and criticize published data and make relevant calculations in the fields of epidemiology, water supply, conservation and environmental management.

The course begins with an introduction to the main themes: natural cycles, how long they take and the influence of human intervention. Then we explain how epidemiology can be used to assess the possible effects of environmental pollution on health. On the subject of the chemistry and biology of pollution, we introduce the elementary chemistry and biology you need for the experimental work and to understand water and air pollution. This will demand a considerable amount of work if you have done little or no chemistry before. These subjects form the first eight weeks' work. The rest of the course discusses the monitoring, health and environmental effects, and methods of control of different kinds of pollution – air, water, noise, domestic and hazardous wastes. Experiments with the home kit are part of the work on water, noise and wastes.

Advice to applicants

The course includes a mathematics supplement for those whose mathematical skill lies somewhere between basic numeracy and O-level. You are not expected to have any knowledge of biology or chemistry; there is a basic introduction to these subjects sufficient for the rest of the course. The amount of work you will need to do on this will depend on whether you already have any biological or chemical knowledge. The first part of the course is designed to give a grounding for the study of water, wastes, noise and air.
The number of places on this course is limited, so you are advised to apply early.

If you are disabled

There are likely to be some difficulties because of the work with the home experiment kit. If you have restricted manual dexterity or impaired sight, in particular, you are strongly advised to seek specialist advice before deciding whether to take the course; it will be necessary to use a burette for titration. There are recordings of printed course materials and transcripts of the broadcasts and cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Sixteen study texts
Supplementary texts

Home kit
You will be lent an experiment kit that includes a burette, rainfall collection apparatus, a pH meter and a sound-level meter. With this you can conduct a wide range of experiments on environmental monitoring, and you will be asked to report on a choice of experiments as part of the work for your tutor.

Outside the UK
Because of restrictions on exporting the kit, this course is not available in Greece or Slovenia.

Broadcasts and cassettes
Eight television programmes
One video cassette
One audio cassette

You will need to buy

Set book
A. Porteous (1998) *Dictionary of Environmental Science and Technology*, 2nd edition, John Wiley, £12.99 (1996 price)

You will also need

Television
Audio cassette player
Video cassette player (VHS)
Scientific calculator

Assessment

There are four tutor-marked assignments, two computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T237 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.
It is also part of the University's Diploma in Pollution Control.

Related courses
Because the subject-matter of T237 overlaps with the discontinued courses PT 272 and T234, you can count only one of the three towards a BA, a BSc or a diploma.

Professional recognition
This course can in some circumstances help you to gain recognition from professional bodies such as the Institute of Biology and many professional engineering institutions. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: the Institute of Acoustics*
3.8 *Membership of professional bodies: scientific institutions*
You can get these from your Regional Centre.

T245

MANAGING IN ORGANIZATIONS

This is a 30-point course at Level 2, with a one-week residential school.
It requires no computing equipment.

The course

This course, revised and brought up to date in 1995, is certainly concerned with the work of people called 'managers', but it is also about managing in the sense of 'coping'. It has practical applications for everyone who deals with people, whether in public or private sectors, large or small organizations, or indeed in vocational or private lives.
Professional managers, administrators and technical staff may see this course as 'management education', but it is equally valuable to, say, shop stewards or session secretaries, play-group leaders or social committee members, to whom it offers a broader appreciation of the work setting and new ways of seeing everyday problems and working relationships.
It is not, however, for 'armchair organizers' who are not involved in any sort of organization. It has a double strategy. First there is the study of a series of concepts that make sense of organizational behaviour and the behaviour of individuals in organizations. Then there is a stage of critical reflection on your own experiences in organizations in the light of the newly acquired insights. You must have plenty of experience – preferably current or recent, to draw on for this stage, since detailed observation of

one's own and other people's actions is necessary in order to recognize the relevance of the concepts taught. The work you do for your tutor is based on personal reflection on your own experience. Simplistic rules or theories of management are not taught, but the course will help you to understand the cross-currents of organizational problems and relationships, to grasp complexities. Briefly, the aims of the course are to:

- Make you familiar with a variety of organizational practices and issues.
- Equip you with 'tools for thought' – concepts, perspectives, techniques – for making sense of complicated problems in organizations.
- Give you practice in applying these tools, both in settings familiar from your own experience and in new situations.

After the course's first year we asked students for their views of this novel approach. Among their replies were many such as:

'It completely turned upside-down all my methods of thought – unsettling but rewarding.'

'I enjoy it and it makes sense of my own experience.'

'Very stretching course in a rewarding way.'

We can give here only an outline showing the scope and structure of the course with little indication of the style and treatment of the material.

Problems about organizations This introductory section discusses the 'messy' problems that often face those who work in organizations and that are at the centre of the course. The conventional view of organizations as rational, unified, goal-seeking entities is questioned.

Work groups introduces the 'control model' as a simple framework for thinking about the control of processes, tasks and work-groups. Practical concepts in individual and group psychology are explained to account for the frustrating and the creative ways in which organizational relationships can develop.

Organization deals with organizational structures, why they matter and what the choices are: with organizational change; with power and conflict in organizations; and with information and decision-making. Along the way different issues and practices are discussed and more ways of thinking about the untidy problems of organizational life are suggested.

Inter-organizational relations shows that inter-organizational relationships often have to be taken into consideration to make sense of organizational events and difficulties. Market (self-regulation) and institutional (hierarchical) patterns of inter-organizational relations are contrasted, and some reasons why neither works quite as intended are explored.

Bringing it all together is intended to consolidate some of your residential school learning, develop your case study analysis skills, help you with the case study questions in Part 3 of the examination, and give you a general review of the course to launch you into your revision for the examination.

There are five television programmes, each related to at least one of the texts. It is a good plan to consult the broadcast notes before the broadcast so that you have a clear idea of what to look out for. In general the programmes either give you more exposure to the concepts by demonstrating their applications, or offer you a chance to try them out for yourself.

Advice to applicants

Texts and associated readings contain some unfamiliar terms, or familiar terms used in an unfamiliar way. You may find that you have difficulty to begin with in adopting and using the different approaches taught in the course but the only requirement is a willingness to read, re-read and ponder unfamiliar ideas. Much the same is true of the diagramming techniques used in the course: no diagramming skill is assumed and there are exercises to help you to learn the techniques. The course does not require mathematics.

Preparatory work

Either of the following books would be useful preparatory reading:

R. Carter *et al.* (1984) *Systems, Management and Change: a Graphic Guide*, Paul Chapman Publishing

D. S. Pugh *et al.* (eds.) *Writers on Organizations*, 4th edition, Penguin

Writers on Organizations is highly recommended as an alternative short but very clear presentation of some of the ideas in the course, and sections of it are referred to in the guidebooks. The third edition is now out of print, and the page numbers of some articles in the fourth edition differ from those given in the guidebooks.

If you are disabled

You may have difficulties with the large amount of reading, the considerable use of diagrams, the television and cassette material, which is drawn on in the assignments, or the residential school. Printed course material is available on audio cassette. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five study texts
Residential school booklet
Guidebooks (study guides)

Broadcasts and cassettes
Five television programmes
Two audio cassettes

You will need to buy

Set book
R. Armson, R. Paton (eds.) *Organizations: Cases, Issues, Concepts*, 2nd edition, Paul Chapman Publishing, £12.95
(1996 price)

You will also need

Television
Audio cassette player

Residential school

The one-week summer school, shared with T247 *Working with systems*, is for many students the high point of the course. It offers a very full programme of activities that will give you practice in applying the ideas you have been studying, and you will meet other students and be able to discuss your progress and problems with tutors and academic staff. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T245 this rule can apply to one assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflet
3.3 *Membership of professional bodies: professional engineering institutions*
You can get this from your Regional Centre.

T247
WORKING WITH SYSTEMS

This is a 30-point course at Level 2, with a one-week residential school.
It requires a personal computer.

The course

This is an introductory course in systems thinking and practice. It will be useful to anyone who has had the experience of being intrigued, puzzled, frustrated or enraged by the behaviour of a system and wants to make it work better. Such people could be managers at any level in the public, private or voluntary sectors, technologists in engineering or computing, NHS medical staff or administrators, or customers of any organization – in fact the course has relevance to most roles in a highly developed and interdependent society that relies on technology.

The course is about the fact that we all have to work in and with complex systems and we don't really understand them. We have neither the time nor the information to think through all the interactions that made them as they are and that determine the success or failure of what we do. So in order to be effective in managing our lives we need to adopt a practical way of thinking about and dealing with these systems. The course teaches this distinctive way of thinking and doing, and half the work you do for your tutor will ask you to apply the course concepts, techniques and methods to your own problems.

There are two kinds of content, the topics and the skills. Topics include the processing of work through a factory or office, ethical investments, pests and pesticides on crops, managing change in organizations, medical diagnosis and how groups make decisions. So there are examples of working with many different kinds of system – natural, technical, socio-technical and social – and the first skills concentrate on different ways to represent and analyse them. The skills you will learn are modelling, diagramming, and applying concepts and techniques to problems you are facing. By the end of the course you will be able to build and use quantitative spreadsheet models of various kinds on a computer. You will also learn to use diagramming techniques to represent systems, as a way to examine your own and other people's thoughts in a form that allows new perceptions and insights into complex problems. Applying the course concepts and techniques will help you to generate and try out ideas for changing and improving the functioning of a wide variety of systems.

T247 complements T245 *Managing in organizations*, with which it shares a residential school. The two courses partly overlap in their use of systems ideas and diagramming techniques.

Advice to applicants

This course builds on the Open University's technology foundation course (T102) in both numeracy and the ability to use spreadsheets. If you haven't taken this course, it would be useful to look at its treatment of these topics. Alternatively, MU120 *Open mathematics* covers the same material. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

If you have not used a computer before you can buy T524 *Working with Windows* before the course begins. We will send you more information, including the cost, if you register for the course.

If you are disabled

You need to be able to use a computer, so please consult the Adviser for Students with Disabilities at your Regional Centre if that is likely to be a difficulty. Work with diagrams is an important part of the course. Printed course material is available on audio cassette and there are transcripts of most of the audio-visual material. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Eight study texts

Broadcasts and cassettes
Four television programmes
Two audio cassettes

Software
Software is supplied on 3.5-inch disks. If you need 5.25-inch disks instead, they can be exchanged.

You will need

Television; audio cassette player.
A computer as described in the leaflet *Personal Computing for Open University Courses 1996/97*, and the integrated software package Microsoft Works or an acceptable alternative. We hope to provide Works at a low cost. We will send you more information if you register for the course.

Outside the UK

You can take this course as long as you have a suitable computer.

Residential school

The one-week summer school, shared with T247 *Managing in organizations*, offers practice in applying systems thinking to real problems and the experience of working in groups. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are four tutor-marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Vocational qualifications
This course can contribute to the award of a *National or Scottish Vocational Qualification*. We will send you more information if you register for the course.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. You can find out more in our Recognition Information leaflets:
1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporations*
3.2 *Membership of professional bodies: Royal Town Planning Institute*
3.3 *Membership of professional bodies: professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
You can get these from your Regional Centre.

For the future

T247 may not be available after 1999.

T205
RENEWABLE ENERGY

This is a 30-point course at Level 2, with no residential school.
It requires a personal computer.

The course

Renewable energy sources, in the form of hydroelectricity and traditional biofuels, already supply roughly twenty per cent of the world's primary energy needs. According to some authoritative studies they could be supplying more than half by the middle of the next century. The main aim of this course is to increase your understanding of the physical, technological, economic and environmental aspects of renewable energy sources, and of their present and potential future role in energy supply systems. By the end of the course you should be able to:

- Understand the basic physical and technological factors that determine the design and use of renewable energy systems.
- Understand in principle how to assess the resources available from renewable energy sources and the economics of using them.
- Appreciate the environmental and social costs and benefits of using renewable energy sources.
- Undertake a project in which you report on the feasibility of a proposed renewable energy scheme, whether it is economically justifiable and what effects it might have on the environment.
- Discuss the main factors that will determine the role that renewable energy sources will play in national, regional and world energy supply systems in the future.

The main text for the course is a book, *Renewable Energy: Power for a Sustainable Future*, that covers the renewable energy sources under eight main headings: solar thermal energy, solar photovoltaics, biomass, hydroelectricity, tidal power, wind energy, wave energy and geothermal energy. It also gives an introductory review of present-day energy use and its effects on the environment, as well as discussing the economic aspects of renewable energy sources and how they might be integrated into future energy supply systems. The main text is supplemented by a collection of reprinted articles and papers in which selected aspects of the subject are explored in greater detail.

There are spreadsheet-based computer exercises to develop your understanding of basic physical, economic and environmental concepts.

Computer-based conferencing will be available if you want to take part in study groups and on-line discussions. The video material includes case studies and animated graphics to aid your understanding of renewable energy concepts and processes. The course also includes a project in which you will be able to investigate and report on the feasibility of a proposed renewable energy scheme.

Advice to applicants

This course has been devised to suit students from a wide range of backgrounds. If you have not studied with the Open University before, we advise you to start with technology foundation course (**T102**). The beginning of this course is designed to bring everyone to the same level of understanding, although you will have a slightly heavier workload in the first few weeks if the ideas are entirely new to you.

If you are disabled

You will need to be able to use a computer.

There are recordings of printed materials, and we hope to provide tactile diagrams and subtitled videos. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Renewable Energy: Power for a Sustainable Future
Study guides
Collection of readings

Software
Spreadsheet exercises

Cassettes
Three video cassettes

You will need

Video cassette player (VHS)
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre)

Assessment

There are four tutor-marked assignments (one is a double-weighted project) and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you towards a professional qualification, and it is recognized by the Chartered Institution of Building Services Engineers and the Institute of Electrical Engineering. You can find out more in our Recognition Information leaflet:
3.3 Membership of professional bodies: the professional engineering institutions
You can get this from your Regional Centre.

T293

COMMUNICATING TECHNOLOGY

This is a 30-point course at Level 2, with a half-week residential school.
It requires a personal computer.

The course

Communication skills are indispensable; we need them when we explain, inform or persuade, we need them when we collaborate and we need them when we learn.

Communication systems are playing increasingly important roles in our lives, and we need to be aware of their potential and their limitations in order to use them effectively.

By studying this course you can gain technological understanding about a variety of modern communication devices and systems and also develop communication skills in the written word, the spoken word, the use of diagrams and in collaborative situations. And since the course puts special emphasis on the learning process, you will also emerge a more skilled and versatile learner.

Communicating technology explores answers to questions such as:

- How can technologists communicate successfully with each other, with other professionals and with the public?
- How do communication systems and devices work?
- How can the potential of communication systems and devices be used to advantage and their limitations be overcome?

The course consists of a short introductory block of material followed by four main blocks. The blocks comprise study texts supplemented by various combinations of video and audio materials, reprints and documents and computer work. The themes in the four main blocks are related to some of the many purposes for which communication can be used:

Enquiring
Explaining and entertaining
Informing and influencing
Creating and collaborating

These themes give a context to the study of such communication systems as television and video, telephones, electronic mail and the Internet, book and journal publishing and multimedia computer systems. They also give context to the communication skills you are developing.

Throughout the course the emphasis is on both the systems and the communication skills you need in order to learn from written, diagrammatic, audio and video materials and to produce written and oral material suitable for its purpose.

By the end of the course you should:

- Have improved your communication skills in reading, writing, drawing, speaking and collaborating, all within a technological context.
- Have an understanding of several communication systems and devices, and of their potential and limitations.
- Be able to apply this understanding to other communication systems and devices.
- Be a more skilled learner.

Advice to applicants

The communication skills of T293 will be useful to anyone who is taking courses in technology or in other areas, and communication systems are becoming sufficiently important to warrant a place in many different study plans. So the course has been designed to fit comfortably into a wide range of studies, though it is of special relevance to students who are concentrating on computers and telecommunications. Related courses at a similar level are THD204 *Information technology and society* and T223 *Microprocessor-based computers*, while T322 *Digital telecommunications* offers a more advanced treatment.

This course builds on the 1996 version of the University's technology foundation course (T102), particularly on the following topics: basic ideas about communication systems (as in Block 2), using a Windows-based computer environment, computer-mediated communication skills, literacy skills, general technology awareness.

Preparatory work

If you have taken T102 in 1996 you could usefully review the topics mentioned in *Advice to applicants*. If you haven't, we will send you preparatory material about communication systems derived from T102 and an introduction to using computer-mediated communications. You will need to spend about fifteen hours working through this before the course begins. If you are not familiar with using Windows, you will also need to buy and work through the Open University pack T524 *Working with Windows* (expected to be available in autumn 1996). The material on databases is not necessary for T293.

If you are disabled

Some parts of the course, particularly Block 4, concentrate on the more visual aspects of communication, including diagrams and video; other parts, particularly residential school, concentrate on its spoken aspects. You may find that you cannot deal fully with those parts of the course and the related assignments. Most of the software for the course runs under Windows rather than DOS, and there is no screen-reader to enable those with impaired sight to use Windows satisfactorily, though we hope that this situation will improve.

There will be recordings of printed course material after 1997, the course's first year. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Five study texts
Five sets of document reprints

Broadcasts and cassettes
One television programme
One video cassette
Two audio cassettes

Software
Software is supplied on double-sided high-density 3.5-inch floppy disks.

You will need to buy

Set books
N. Stanton (1996) *Mastering Communication*, Macmillan, £8.99
The Oxford Concise English Dictionary, 9th edition, Oxford University Press, or the equivalent Collins or Chambers dictionary
(1996 price)

You will also need

Television
Video cassette player (VHS)
Audio cassette player
Computer as described in the leaflet *Personal Computer for Open University Courses 1996/97* (available from your Regional Centre). You are strongly advised to buy at least a V32 bis (14 400 baud) modem. Microsoft Works for Windows is the preferred integrated software package for the course. We hope to provide Works at a low cost; we will send you more information if you register for the course. If you choose to use alternative software you should make sure that it can handle documents, diagrams and spreadsheets supplied in Microsoft Works for Windows format. A CD-ROM drive is optional.

Residential school

There is a half-week summer school (Saturday to Tuesday or Tuesday to Friday) that offers practice in two communication skills useful to technologists: giving a presentation and collaborating with others in a group. The fee for the school (£95.50 in 1996) is not included in the course fee.

Assessment

There are five tutor-marked assignments, three computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T293 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Vocational qualifications
Although it is not a formal part of the course, you could prepare a portfolio of evidence of your communication or learning skills as you work through the course and use it if you register for a GNVQ at level 4.

Professional recognition
The course team intends to propose the course to the Institution of Electrical Engineers for inclusion in their list of recognised Open University courses.

THD204

INFORMATION TECHNOLOGY AND SOCIETY

This is a 60-point course at Level 2, with no residential school.
It requires a personal computer.

The course

This broadly based course explores some of the main social and technological issues to do with the introduction of information technology (IT) in our everyday lives. It offers historical and comparative views of the social and technological processes involved in the uses, control of and access to various forms of IT applications, and critically examines some of the assumptions underlying technological development. Its aim is to enable you to make informed and critical judgements about these issues and to relate them to your own experience.

The course combines several innovative approaches to distance learning, including computer communications and CD-ROM technology. The printed texts provide the basis, but you will be expected to make extensive use of over 300 indexed articles on CD-ROM, and to take advantage of computer networks to gain access to tutorial support and of the Internet to search for further learning resources.

The course is divided into five main sections together with an introduction and conclusion. The *Introduction* presents a general view of the course and sets out its issues, questions and themes.

Differing perspectives takes a closer look at the different views that social scientists and technologists have of IT developments. Technological determinism and social shaping are just two of the social theories that are reviewed as part of the background to the social perspective, while the technological perspective looks at the convergence of technologies and the digital representation of various kinds of information. The last part explores the influence these different perspectives have on our understanding of an evolving information society.

IT and change in the workplace Much of the growth and development of IT systems takes place in the workplace. We examine these developments and their implications for future employment, the changes in organizational management structures and the increasing use of

groupware. Particular attention is given to the various forms of computer network used to support IT, the decision-making process itself (with software activities) and the broader questions of access, quality control and the *automation of bias*.

IT and learning examines the role of IT in the learning process, either in schools or at work, and discusses how IT has been used and adapted to meet the special requirements of teaching and training. The topics include the economics of technology-based training; computer-supported co-operative working; support for the disabled learner; theories of learning; and inequalities. You will also acquire the study skills you need for the resource-based learning approach of the course, in particular how to make appropriate use of the multimedia elements so as to tackle the questions raised in its second half.

At home with IT explores the growing use of IT products and services in the home and discusses how technology is transferred from commercial to domestic environments, how choices are made and who makes them. We examine how IT can break down boundaries between households and the outside world and become a medium for global rather than local communication. One case study looks at the use of IT to make local government more democratic.

IT futures comprises several short segments that review particular technological developments. It is designed to ensure that the course remains topical as we approach the twenty-first century, and considers:

Safety systems and the limits of computers
Teleworking
Broadband communication services and systems
Rehabilitation and IT
Virtual realities

Practical work

This is an important part of the course, enabling you to develop practical skills with a personal computer, computer networks and CD-ROMs. Computer networks will have a crucial role in communication between you and your tutor, with other students and with the course team at Walton Hall. Electronic mail and conferencing will also play a part in the discussion and collaborative writing for the group project assignment, and in the electronic submission of the final reports.

Advice to applicants

You are not expected to have any knowledge of IT, and the necessary technological and social science skills are developed in the course. Nevertheless, the course does require study skills such as ability to follow an argument, to relate information from tables, graphs or maps to text discussion, and to formulate a reasoned case in discussion and written work. Either D103, the University's social science foundation course, or T102, the technology foundation course, would prepare you well for *Information technology and society*. Your Regional Centre will be able to tell you where you can see reference copies of the foundation courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

The most useful preparation is to make sure that you have a computer and CD-ROM drive of the right specification, and a BT jack socket. Check that your equipment has been supplied with all its parts, and that they are working properly. You should be sure that it is all in order before the first week of the course. It would also be useful to develop your keyboard skills.

If you are disabled

You may not be able to complete all the practical activities or to get the full benefit from the computer network and the course materials on the CD ROM disks. All the course software runs under Windows, so we hope that students who have visual disabilities will be able to use one of the many screen-text to speech-synthesizer packages available on the market, though we cannot guarantee that all the course software will work in conjunction with these packages. Recordings of course materials will not be available, but there are transcripts of most of the television programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Study texts
Course reader

Broadcasts and cassettes
Five television programmes
Audio tracks on CD disks

Software
The course materials include several software packages for use with the computer networks and the CD-ROM; they all require Windows 3.1 or Workgroups for Windows 3.11 (or later versions). The CD-ROM disks contain a 'resource library' of articles and papers.

You will need to buy

Set book
P. Zorkoczy, N. Heap *Information Technology: an Introduction*, 4th edition, Pitman, £15.99 (1996 price)

You will also need

Television
Video cassette player (VHS)
Computer paper
Blank computer disks

Computer
You must have access to a computer and modem as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre). To use a modem you will need a telephone line fitted with a British Telecom 600-series jack socket. If your telephone does not have a jack socket you will need to arrange for BT to convert the connection. Please do so in good time, because it can take some weeks for your request to be carried out. You will be paying for the telephone charges associated with the use of the computer networks. For most students this will be at the local rate.

Assessment

There are five tutor-marked assignments, a project and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of THD204 overlaps with the discontinued course DT200, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by the Institution of Electrical Engineers and the Institute of Marine Engineers, and is included in the Open University degree profile recommended by the police training authorities. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporation*
3.2 *Membership of professional bodies: the Royal Town Planning Institute*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*

You can get these from your Regional Centre.

For the future

THD204 will be presented for the last time in 2000.

U220
ENVIRONMENTAL POLICY IN AN INTERNATIONAL CONTEXT

This is a 60-point course at Level 2. It has no residential school and requires no computing equipment.

The course

This course is jointly produced by the Open University and the Open University of the Netherlands. It is for anyone who is interested in the nature of international environmental issues, such as pollution or degradation of air, water and land, and why they have become politically important. The course is of topical interest in its concern with the relationship between development and environment, and between local and global matters. It takes a critical and analytical look at international environmental issues as products of today's world, asking what international environmental problems are and why they have taken on political importance. The course is in three parts, presented in three textbooks and a workbook. It concentrates on conceptual and theoretical analysis, illustrated by a variety of environmental topics, policies and practices. It looks critically at such concepts as sustainable development; examines the interrelationships between national and international politics and policies; considers the implications of the dictum 'think globally, act locally'; investigates the role of international governmental organizations, non-governmental organizations, voluntary agencies and other bodies in lobbying and decision-making; and suggests what the prospects might be for greater participation by people at local level. A prominent theme is the interaction between power and policy-making, and the consequences of their interaction.

The course considers the need for an interdisciplinary approach to the analysis of environmental problems in the international context, introducing ways of looking at both their physical and their social characteristics and examining their causes, which are seen as arising from conflicts of interest. A series of national and international case studies brings out themes, in particular the idea that environmental problems can be analysed as problems both of development and of distribution of resources. We look at the constraints and opportunities for international environmental policy-making, with a further series of case studies that emphasize political conflict, institutional involvement, the role of different governmental and non-governmental agencies, and the scope for action and achieving results. We survey international relations as they affect environmental issues, asking how far international political action can achieve sustainable development, and in whose interest such action is being taken. Finally, we look at prospects for sustainable development in terms of relationships between society and the environment.

Advice to applicants

You are not expected to have any special knowledge, but you are expected to be able to formulate a reasoned case in discussion and written work. You can get some idea of the level of study required by looking at the course materials of any of the University's foundation courses. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy them from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes, MK11 1BY.

Preparatory work

In order to develop an awareness of the issues surrounding environmental policy in an international context you might like to read relevant articles in the quality press. There are also many books available in libraries and bookshops that would be useful preparatory reading.

If you are disabled

The course should present no special difficulties, and there will be recordings of printed course material. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Three study texts
Workbook

Broadcasts
Six television programmes

You will need

Television

Assessment

There are seven tutor-marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.2 *Membership of professional bodies: the Royal Town Planning Institute*
3.5 *Membership of professional bodies: the Institute of Wastes Management*

You can get these from your Regional Centre.

U205
ENVIRONMENT

This is a 60-point course at Level 2. It has no residential school and requires no computing equipment.

The course

Environmental issues are much talked about, with every political party, supermarket chain and motor manufacturer claiming to be 'greener' than its competitors. The issues range from the very local, such as felling trees to widen a road, to the global: ozone depletion and the greenhouse effect. Some affect amenity for particular groups, some affect public health or the availability of resources and others threaten the survival of species or even of life itself. Everyone wants the answers to these problems, and they are constantly discussed in the media. Environmental problems are very complex; natural chemical or biological processes, technology and social, economic and political pressures may all play a part. Since some people may reap a benefit from an activity that generates an environmental problem, a technical solution may not be readily adopted even if it is practicable. So an understanding of environmental questions demands a blend of scientific, technological and social scientific concepts and skills. This has posed a serious challenge to the authors of the course and, although we have tried to teach these skills in a gradual way, it will also pose a challenge to you. The challenge will concern your values as well as your skills, because the course not only widens your awareness of environmental issues and deepens your analysis of their causes and consequences but goes on to consider what action should be taken about them. It is necessary to evaluate alternative policies and to consider possibilities ranging from the local to the global.

The course is presented in four books. *Environment and society* presents different ways of seeing environmental issues. The opening chapter uses common sense views of Cumbria to demonstrate the need for a better scientific understanding of how environments work and how society changes them. The next two chapters consider the effects human societies have had on their environments, and changing attitudes to environments through history. The second part of the book looks at the Earth as an

environment for life, examining how the inhabitants of the biosphere have influenced it, and how organisms found in habitats function together. This more purely scientific part of the book is linked to the first three chapters, which emphasize social considerations, by a chapter on today's global problems to do with environment and development.

Environment, population and development considers agricultural systems, rural systems and urbanization against the background of population and economic growth. The sustainability and productivity of various agricultural systems are analysed, and the countryside of the UK, seen as a complex system of competing interests, serves as a case study that takes a wider view. A chapter on world trade and its environmental effects demonstrates the essential link between agriculture, industry and the development of settlements. Urban environmental problems are examined in a context that embraces the origins, functions and sustainability of settlements.

Energy, resources and environment analyses the environmental consequences of using non-renewable energy resources and industrial minerals, then examines the potential environmental effects of using renewable resources and their associated technologies. Subsequent chapters discuss the impact of manufacturing processes and their regulation. Approaches to the general problems of dealing effectively with industrial wastes are also considered, but the concluding section of the book is devoted to the political conflicts that arise from the disposal of nuclear wastes.

Global environmental issues examines the main scientific, political and economic considerations associated with serious environmental problems and with the construction of international regimes to tackle them. It deals with the exploitation of the oceans, ozone depletion, global warming, biodiversity, sustainable development and the conflicts that arise in the quest for acceptable policies. The course ends with an examination of the outcomes of the UNCED world summit of 1992, and the continuing diversity of environmental values.

Advice to applicants

You are not expected to have any special knowledge.

Preparatory work

The best preparation is to search quality newspapers and serious television programmes for items on environmental issues and policies. Scan periodicals in your local library, including *Environment*, *New Scientist* and *The Ecologist*, and look for environment-related articles and editions in journals of all kinds. You might also find useful *One World for One Earth: Saving the Environment* by P. Sarre, P. Smith and E. Morris (1991, Earthscan Publications in association with the Open University and the World Wildlife Fund for Nature).

If you need to improve your study skills, work through *The Good Study Guide* by Andrew Northedge (The Open University).

If you are disabled

The course is heavily illustrated and makes active use of figures and television. You will be able to choose a project that does not require fieldwork, but most projects will mean visits to libraries and perhaps to places such as planning offices.

Printed course materials are available on audio cassette and there are transcripts of the television programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Four study texts
Course guide
Project booklet
Assignment handbook
Broadcast handbook
Audio-vision booklet
Glossary

Broadcasts and cassettes
Eight television programmes
Two audio cassettes

You will need

Television
Audio cassette player

Assessment

There are eight tutor-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In U206 this rule can apply to two assignments. You will be given more detailed information when you begin the course.

Project work

A small-scale local project is designed to relate the larger issues the course discusses to your everyday life. You will be asked to choose, from your local newspapers, broadcasting and so on, an issue of particular interest to you, to obtain information about it and to present a report in the form of an argument to an appropriate decision making body that certain action should be taken. You will need to put together an argument that deals with values as well as facts. This project, guided by a handbook, is so important to the course that you should carry it out even if you don't intend to be assessed for the course as a whole.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

It is also part of the University's Diploma in Environment and Development.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body such as the Institute of Biology or certain of the professional engineering institutions. You can find out more in our Recognition Information leaflets:

3.2 *Membership of professional bodies: the Royal Town Planning Institution*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.8 *Membership of professional bodies: scientific institutions*

You can get these from your Regional Centre.

For the future

The course will be presented for the last time in 2000.

U206

THIRD WORLD DEVELOPMENT

This is a 60-point course at Level 2, with a one week residential school.
It requires no computing equipment.

The course

This course asks 'What can be done about Third World development?' and, taking a multidisciplinary approach with examples drawn from social science, arts, science and technology, it helps you to evaluate possible answers to this question. The causes of hunger, poverty, disease and uneven development and solutions suggested for overcoming them are examined, and by the end of the course you should be equipped to take a problem-solving approach to issues to do with development. The course is divided into four parts, each with a textbook, study guide and programmes on television, radio and audio cassette.

Part 1 introduces the problems in developing countries and the historical background to them. The textbook is called *Power and Development in the 1990s: an Introduction*.

Part 2 is about the process of development through industrialization. It examines the theoretical approaches to understanding development by describing and assessing particular instances of industrialization in developing countries. The textbook is *Industrialization and Development*.

Part 3 investigates food production and peoples' survival, particularly in the countryside. It introduces analytical concepts to do with gender and the household, markets and distribution, environmental influences on food production, agricultural and technical change and international trade. The textbook is *Rural Livelihoods: Crises and Responses*.

Part 4 draws on what you have learnt so far to explore what can be done about Third World development. It examines the ways in which states and other agents can influence development policy and what may limit their ability to do so. The textbook is *Development Policy and Public Action*.

There are twelve television and four radio programmes. We hope that you will find them enjoyable as well as useful. The television programmes act as field trips to some of the countries featured in the course; they offer observations from people in developing countries, illustrate some of the theoretical concepts introduced in the course and encourage you to reconsider conventional images of the Third World. The radio programmes, each associated with one part of the course, show the continuing influence of world events on the course topics and generally keep you up to date. Four audio cassettes present music from different parts of the world.

Advice to applicants

You are not expected to have taken any other courses before this one.

Preparatory work

No single book will introduce the course completely, but any of the following suggestions gives some coverage of the issues from different points of view. You are not expected to read all of these, but they give a taste of the subject.

UNDP Human Development Report 1990, United Nations Development Programme, Oxford University Press. A useful source of data to do with development, and lots of information about developing countries all based on measures of 'human development'.

A. Foster Carter *The Sociology of Development*, Causeway Books. A simple introductory text from a sociological point of view. Short and easy reading.

H. Bernstein, B. Crow, M. Mackintosh, M. Martin (eds.) *The Food Question*, Earthscan. A collection of short and accessible chapters produced by members of the Open University, covering the many issues to do with food in developing countries.

G. Sen, C. Grown *Development Crises and Alternative Visions: Third World Women's Perspectives*, Earthscan. Another short and clearly written text that concentrates on women in developing countries.

Any novel by Chinua Achebe: *Anthills of the Savannah*, *Things Fall Apart*, *No Longer at Ease*, *A Man of the People*.

If you are disabled

The course includes a certain amount of visual material, particularly in the *Third World Atlas*. There are recordings of printed course material and transcripts of the television programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Course guide
The four textbooks
Anthology of literature from Africa, Brazil and India
Four study guides that accompany the textbooks and include readings and study suggestions
Notes to accompany the television programmes and the audio cassettes
Summer school handbook
Summer school materials, including notes for activities at the school

Broadcasts and cassettes
Twelve television programmes
Four radio programmes
Four audio cassettes

You will need to buy

Set books
H. Bernstein, H. Johnson (eds.) *Third World Lives of Struggle*, Heinemann Educational Books, £13.50
Tsitsi Dangarembga *Nervous Conditions*, The Women's Press, £5.95
C. Lispector *The Hour of the Star*, Carcanet Press, £5.95
The *Third World Atlas*, Open University Press (revised edition 1994), £12.99
(1996 prices)

You will also need

Television
Radio
Audio cassette player

Residential school

The one-week summer school gives you an opportunity to meet other students and tutors, to take part in activities based on topics explored in the course and to hear speakers from the UK and overseas. The fee for the school (£199 in 1996) is not included in the course fee.

Assessment

There are nine tutor-marked assignments (one of them will not count towards your course result) and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In U208 this rule can apply to one assignment, but not to either of the last two. You will be given more detailed information when you begin the course.

Award

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

It is also part of the University's Diploma in Environment and Development.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflet:

3.2 *Membership of professional bodies: the Royal Town Planning Institute*

You can get this from your Regional Centre.

For the future

The course will be presented for the last time in 1999.

T301

COMPLEXITY, MANAGEMENT AND CHANGE: APPLYING A SYSTEMS APPROACH

This is a 60-point course at Level 3, with no residential school.
It requires a personal computer.

The course

We are all involved in management in its widest sense – public, private or personal, play-schools or prisons, people or products. How we organize ourselves to tackle problems is a mixture of intuition, experience and skills. This course will enable you to apply systems ideas and methods to complicated problems and difficult issues you may be faced with.

Simple problems may require only simple skills, but a systems approach starts from the premise that real decisions cannot be neatly separated into individual problems with simple solutions. They are much more likely to be systems of

unstructured problems. This practical course will give you techniques and experience to help deal with such problems arising in complex human systems like companies, schools and governments. You will become familiar with systems methods for understanding, modelling and possibly changing the part of the world in which you operate. The course is based on three complementary systems approaches:

- The analysis of systems failures and catastrophes (a systems approach to failures).
- A systems modelling approach to organizational decision making (hard systems analysis).
- A systems approach to organizational change (soft systems analysis).

You study all three approaches and then apply one of them in an extended project. The main teaching takes place in the first twenty weeks of the course and is followed by ten weeks of project work and two weeks in which the themes in the course are drawn together. The four audio cassettes are used to help with diagramming, to present interviews that complement the case studies, and to illustrate and enlarge on some of the theories and ideas introduced in the texts.

Systems ideas, background and philosophy introduces the essential features of a systems approach, including its nature, concepts and phases. There is much that will interest continuing systems students, as well as the necessary grounding in systems ideas for new students. The text is based on the set book *Systems, Management and Change: a Graphic Guide* and covers the basic activities (analysis and assessment, organizational groundwork and implementation) that need to be combined in effecting change in organizations. A method for systems description and some diagramming techniques are introduced.

The analysis of systems failures develops a practical understanding of failures ranging from small-scale incidents to catastrophes, from local problems to questions of regional or national policy. Particular attention is paid to the human element and the relationship between failure, or alleged failure, and the expectations of the people and organizations concerned. You start with the set book *Understanding Systems Failures*, which comprises accounts and explanations of failures, some indisputable and others a matter of value judgement, and offers a first look at the approach to be studied in detail and practised. The approach starts from the premise that failure must always be recognized as the outcome of the complex activities in which we engage, then applies classic systems insights in order to identify the origins of mistakes and how they were allowed to develop. The aim is to arrive at a systemic understanding of a situation as a preparation for planning and making changes.

A systems modelling approach to organizational decision-making studies systems that are amenable to precise modelling and definition. The 'hard systems approach' that it teaches can be used to solve management problems and aid decision-making when the systems objectives can be clearly defined. The use of this approach is illustrated by case studies of research and development decision-making in the agrochemical industry, which shares many problems (declining rate of growth, higher investment in research and development, increasing interference from government and other agencies) with other industries; additional material is drawn from management in other areas. Mathematical modelling techniques are introduced to give you a basis for judging what kinds of model might be appropriate in different circumstances.

A systems approach to clarifying and facilitating organizational change When there is agreement about what is wrong and what would constitute an acceptable state of affairs, the modelling approach is both appropriate and powerful. But many problems are not like that: people have conflicting perceptions of the state of affairs and different ideas of what 'the problem' is and what might constitute an improvement. The 'soft' systems approach is a method for using system ideas to help people understand the problems in which they are involved and work out policies and actions to improve things. Exercises and assignments teach you the basic steps and give you some initial experience of using them.

Comparing systems approaches helps you to reflect on the three systems approaches you have learnt before beginning the project. It introduces some of the considerations that must be taken into account when comparing the three approaches and choosing the appropriate one for a particular problem.

Project You will apply one of the three approaches, with guidance on how to undertake project work and suitable topics for each approach. You can choose one of three set topics or choose your own topic (with the approval of your tutor) and use the appropriate approach. The set topics are:

- A project on failures, using information from reports and articles about public sector housing. From this and other material you may gather you use the method you have been taught to analyse the failures implicit in the hypothetical situation.
- The project using the hard systems approach asks you to apply the modelling technique you have learnt to a case based on real decisions in the agrochemical industry.
- To use the third approach you need to negotiate access to a voluntary organization, then use the method you have been taught to carry out a soft systems analysis.
- If you choose your own project you must define a manageable topic, collect and analyse, using one of the approaches taught in the course, all the necessary information and submit a report.

The last two weeks of the course deal with the difficulties associated with the practical application of systems approaches and offer advice about planning future systems investigations.

Advice to applicants

This course has been devised to suit students from a wide range of backgrounds and you are not expected to have studied any other courses first. The beginning of the course is designed to bring everyone to the same level of understanding, although those who are entirely new to systems ideas will have a slightly heavier workload in the first two weeks.

Preparatory work

If you would like to do some preparatory work you could make a start on the set books.

If you are disabled

The project may require use of a computer, visits to libraries or communication with officials and groups in the local community, but there is a choice of topics. Diagrams are used extensively throughout the course, and printed material is not at present available on audio cassette, but there are transcripts of the course cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Seven study texts, including project manual
Five audio cassettes

You will need to buy

Set books

R Carter, J. N. T. Martin, W. Mayblin, M. Munday (1984) *Systems, Management and Change: a Graphic Guide*, Paul Chapman Publishing, £4.95

V. Bignell, J. Fortune (1984) *Understanding Systems Failures*, Manchester University Press, £9.99

(1996 prices)

You will also need

Audio cassette player

If you choose the hard systems approach for your project you will need a computer as described in the leaflet *Personal Computing for Open University Courses 1996/9*" (available from your Regional Centre). You will not need Windows. MSDOS will suffice.

Assessment

There are eight tutor-marked assignments, one computer-marked assignment and an examination. One of the tutor-marked assignments and the computer-marked assignment will not count towards your course result. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T301 this rule can apply to one tutor-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses

Because the subject-matter of T301 overlaps with the discontinued courses T341 and TD342, you can count only one of the three towards a BA or BSc.

Vocational qualifications

This course can contribute to the award of a National or Scottish Vocational Qualification. We will send you more information if you register for the course.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body or employer. It is recognized by the Institution of Analysts and Programmers, and is included in the Open University degree profile recommended by the police training authorities. You can find out more in our Recognition Information leaflets:

1.4 *Particular careers: Civil Service, armed forces, merchant navy, police and public corporations*
3.2 *Membership of professional bodies: the Royal Town Planning Institute*
3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

For the future

This course will be presented for the last time in 1999.

T202

INNOVATION: DESIGN, ENVIRONMENT AND STRATEGY

This is a 60-point course at Level 3, with a one-week residential school.
Use of a personal computer is optional.

The course

Technological innovation is widely believed to be the key to the economic and commercial success of both companies and countries. Why do some technical innovations succeed while many others fail to find a market? Why has Britain a reputation for being good at invention but poor at exploiting new ideas as innovations? How does the British approach to innovation compare with that in other countries such as the United States, France and Japan? What is the most effective way of organizing for technological innovation and managing innovative product development? What should be the role of governments in innovation? What are the global forces that shape the development of technological innovation? And what skills and techniques do technologists, designers and managers need if they are to innovate in the 1990s and beyond?

The course is concerned with the development of technically innovative products, from market research, creative invention and generation of ideas, through research design and development, to manufacture and sales. It emphasizes the necessity of balancing technical possibilities against market requirements if an innovation is to succeed, and of managing the whole process effectively. The course also shows why it has become more and more important to consider the social and environmental consequences of any technological innovation, and discusses moves towards the development of 'greener' products and 'cleaner' processes.

The course will teach you about different models of the innovation process, help you to learn some basic practical techniques including market research, patenting and project management, and enable you to understand influences on technological innovation such as individual inventiveness, company strategies, environmental constraints, government policies and globalization of markets. The practice and management of innovative product development is compared with theory through a series of case studies in areas such as energy, information technology and transport. The course also explores the prospects for developing environmentally sustainable strategies for technological innovation.

An important element of the course is a project that runs through much of the year. It will give you an opportunity to try your hand at parts of the innovation process, either by generating and developing a new product idea or by developing an innovation or design case history. Support for this project work is provided by your tutor and at the residential school as well as through a series of course booklets.

The course consists of seven texts, each including a set of case studies and readings and a guide to skills and techniques relevant to the project. (The titles shown here are provisional.)

An introduction to innovation From invention to innovation
Inventors and innovation From ideas to markets
Markets and innovation From needs to markets
Innovative product development Practice and management of innovation at strategic, organizational and project levels
Technology policy Government research and development programmes and support for innovation
Global patterns in technological innovation Global influences on technological change
Conclusion The future for innovation

The audio-visual elements of the course are used to illustrate and support the texts. Some texts incorporate video notes and activities, while others use them to supplement features of the innovation and design processes. The audio cassettes include interviews with inventors and innovators as well as offering guidance and advice for the project and the examination.

Advice to applicants

This interdisciplinary course enables you to explore the technical innovation process by means of case studies, theoretical concepts and practical project work. It is designed to be fully accessible whether you have a technical background or not. You can get an idea of the level of study by looking at the course materials of T204 *Design, principles and practice*. Your Regional Centre will be able to tell you where you can see reference copies of this, or you can buy it from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

You might find it useful to look at *Product Design and Technological Innovation* by R. Roy and D. Wield (Open University, 1989).

If you are disabled

You might need to think particularly carefully about your choice of project. There are no recordings of printed course material or transcripts of broadcasts or cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material

Study texts
Project guides
Notes to accompany the audio and video cassettes

Broadcasts and cassettes
One television programme
Four video cassettes
Audio cassettes

Computing (optional)
The course does not require a computer, but if you have access to equipment as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre) you are likely to have opportunities to use it, perhaps for your project work, for example. Optional computing activities will also be offered at the residential school.

You will need

Television
Video cassette player (VHS)
Audio cassette player

Residential school

There is a one week summer school. The fee for it (£199 in 1996) is not included in the course fee.

Assessment

There are seven tutor marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T302 this rule can apply to any one assignment except the last one. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *E*, which means that it is equally appropriate to either.

Related courses
Because the subject-matter of T302 overlaps with the discontinued course T362, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. It is recognized by ten of the professional engineering institutions in the Engineering Council. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: professional engineering institutions*
3.5 *Membership of professional bodies: Institute of Wastes Management*
You can get these from your Regional Centre.

T302
ENVIRONMENTAL MODELLING, MONITORING AND CONTROL

This is a 60-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This course is about strategies for controlling environmental pollution; it analyses pollution control problems and performance specifications. It builds on the Open University course T237 *Environmental control and public health*, consolidating the material in that course and taking you on to the design specification stage in selected areas of pollution control.
Computing is used throughout the course to enable you to do routine calculations, computer simulation modelling of pollution problems and detailed project work. Of the study time, approximately two-thirds will be spent on the units and modelling, and one third on a project that draws together the different areas of study.
By the end of the course you should be able to:

- Analyse environmental control problems and perform design calculations
- Set performance specifications.
- Model pollution problems such as chimney emissions, effluent dispersion, leachate dispersion, outdoor noise propagation and internal noise prediction.
- Show an appreciation of the costs and benefits of selected environmental pollution control strategies.

The course is presented in loose-leaf format with notes and explanatory texts associated with either published textbooks or journal reprints.
Waste management reviews the nature, characteristics and quantities of the two main types of waste, domestic and hazardous. Waste disposal techniques for both include transport, land fill site selection and management, other methods of disposal, leachate and gas control, water pollution protection and site after-use. For domestic waste, recycling is an important topic, particularly energy recovery methods and their economics. Trends in waste management are also explored.
Noise begins by revising basic concepts such as units, criteria and indices, legal and social control and planning. The technical aspects of noise control including prediction schemes and sound insulation of buildings are important topics. There are case studies of public enquiries and of industrial noise.
Water The two main topics are the theory and practice of:
Water supply (estimation of demand, quality treatment processes, design and economics) for domestic and industrial applications.
Effluent (sewage and trade) control, sewerage systems, design and economics.
Air revises the nature and characteristics of air pollution and discusses the interpretation of air quality data. Other topics include automobile emissions, air pollution dispersion, modelling and calculation of chimney heights, and control of particulates.
The audio cassettes offer advice for the project.

Advice to applicants

This course has been designed for practising environmental professionals in land, air, water and noise pollution who want to bring their knowledge up to date. You need a working knowledge of basic chemistry and mathematics, but you are not expected to be familiar with computing; you will be given help in this area. You are strongly advised to take T237 *Environmental control and public health* before this course, and you will benefit from taking T303 as soon as possible after T237. (T237 has replaced the earlier course T234; if you took T234 you will be equally well prepared.) If you have not taken T237 your Regional Centre will be able to tell you where you can see reference copies of it, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

We will send you a preparatory pack on the use of personal computing in the course.

If you are disabled

You must be able to use a computer. If you need to use a computer with adaptations, please consult the Office for Students with Disabilities, The Open University, PO Box 79, Walton Hall, Milton Keynes MK7 6AR. Recordings of printed course material will not be available in 1997, the course's first year. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
G. Smethurst (1988) *Basic Water Treatment*, 2nd edition, Thomas Telford Publications
Four study texts

Cassettes
Two audio cassettes

You will need

Audio cassette player
Scientific calculator
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are eight tutor marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T303 this rule can apply to one assignment but not to the project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.
It is also part of the University's Diploma in Pollution Control.

Related courses
Because the subject matter of T303 overlaps with the discontinued course T334, you can count only one of the two towards a BA, a BSc or a diploma.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:
3.5 *Membership of professional bodies: Institute of Wastes Management*
3.7 *Membership of professional bodies: Institute of Acoustics*
You can get these from your Regional Centre.

T303
DIGITAL TELECOMMUNICATIONS

This is a 30-point course at Level 3.
It has no residential school and requires no computing equipment.

The course

The techniques, applications and scope of telecommunications are changing very rapidly. The availability of cheap integrated circuits is leading to more and more complex forms of signal processing. New media such as optical fibres allow vast amounts of digitally coded information to be transmitted over long distances with extremely low error rates. The electronic storage of signals and control information at the nodes of telecommunication networks allows optimum use of equipment and channels, and the smoothing out of demand peaks.
This course introduces important concepts and techniques applicable to the design and operation of complex modern telecommunication and information technology. Because of the scope of the subject it is not possible, in a 30-point course, to develop expertise in the application of individual techniques, but some of these are illustrated through case studies.
After a brief introduction the course begins with a study of packet switched systems and the Open Systems seven-layer architecture. Then it deals with reliability, traffic theory and the basic principles of information and coding. Next comes a discussion of the time and frequency domain properties of the basic pulsed signals used in digital systems. This is followed by a consideration of noise and the many coding and modulation techniques used to transmit digital signals. A system study of digital telephone exchanges includes switching and signalling techniques and the specification, use and maintenance of telecommunication software. The basic properties of transmission media, including antennas, are introduced, and a system study of an optical fibre transmission system deals with the design of appropriate optical transmitters and receivers. The course ends with a system study of local area and wide area networks.
By the end of the course you should be able to:

- Understand technical descriptions of present and future telecommunication equipment, techniques, networks and services.
- Understand the possibilities, the theoretical and practical limits and compromises inherent in the design of telecommunication systems.
- Evaluate and make informed choices between different telecommunication services.

Many of the skills you will learn as you achieve these objectives have applications outside telecommunications; for example you will have learnt about the analysis of system reliability and encountered formal methods for the specification and description of complex systems. Because of the increasing importance of distributed storage and processing in computer systems and of local area networks, the course is also appropriate if you are interested in computing.

Advice to applicants

You will not find many electronic circuits described in the course, but because information in telecommunication networks is mostly processed electronically you need some familiarity with electronic signals and systems. T202 *Analogue and digital electronics* would give you a more than adequate background. (If you have taken one of the discontinued courses T283 *Introductory electronics* and T292 *Instrumentation*, you will also be suitably prepared.)
Similarly, although you are not required to carry out complex mathematical manipulations, the course does make extensive use of mathematical descriptions. You must be able to understand complex numbers and algebraic formulae (including logarithms, exponentials and trignometric functions), interpret mathematical models, some of which use elementary integration and differentiation, and follow simple mathematical proofs. M101 *Mathematics: a foundation course* or MST204 *Mathematics: models and methods* would be a suitable preparation; or mathematical skills to a level somewhat below A-level should be sufficient, provided that you have had extensive experience of using those skills.
All the techniques described in the course are explained from first principles but you are expected to have some knowledge of telecommunication systems, such as you would get from THD204 *Information technology and society* or T202 *Analogue and digital electronics*. Your Regional Centre will be able to tell you where you can see reference copies of all the courses mentioned here, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

Preparatory work

You might find it useful to look at *Information Technology: an Introduction* by P. Zorkoczy and N. Heap (4th edition 1995, Pitman). Many of the basic ideas covered in the course are introduced in *Telecommunications Technology* by R. L. Brewster (1987, Ellis Horwood).

If you are disabled

Since the course contains complex visual material it has not been possible to make the texts available on audio cassette. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Ten study texts
Mathematics reference booklet
Booklet of formulae, tables and index
Diagrams for use with the audio cassettes
Offprint booklets
Three audio cassettes

You will need

Audio cassette player

Assessment

There are four tutor-marked assignments, five computer-marked assignments (one will not count towards your course result) and an examination. The University expects you to complete all the assessment because it is an

central part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a substitution score, calculated as a weighted average of all your scores for the course. In T322 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.7 *Membership of professional bodies: the Institute of Acoustics*

You can get these from your Regional Centre.

For the future

If you are thinking of taking the course in 1998, you will need to ask your Regional Centre for confirmation that it is still available. After that we expect to replace it by another course in a similar subject area, but the details have yet to be decided.

T322

LOGIC DESIGN

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

The central theme of this course is the analysis, specification and design of digital circuits: a wide variety of circuits is covered, using examples from such areas as telecommunications and computing. By the end of the course you should be able to:

- Appreciate the various design techniques for different digital structures.
- Be aware of digital electronic design tools.
- Translate a high-level design specification into a detailed description using various representations.
- Optimize a detailed design.
- Construct simulation data to simulate a design.
- Use software tools to construct and simulate a design.
- Write a concise report that discusses the design decisions made and the results obtained.

The course is based on a book, *Fundamentals of Logic Design* sent to you as part of the course materials, that teaches the theory of the analysis and specification of design methods and their application. A computer-based design package, whose software is widely used in industry, helps you with the practical implementation of your design. The book and the computer package are supported by study and computing guides.

The topics covered by the course are Boolean algebra and its application to simplification techniques; multiple-output networks; sequential networks; state graphs and tables; arithmetic networks; state machine design; asynchronous networks. The practical work includes design specification; schematic capture of a design (using a mouse to draw on screen a circuit diagram that the software converts into a data file); and waveform construction, leading to simulation of the captured circuit. You will undertake two design exercises, each taking a week of study time. The first concentrates on aspects of a digital tele-communication circuit, and the second on a circuit from a computer. You will also prepare a project report based on the topics and techniques introduced in the course, and on the computing package, which will give you an insight into the kind of project work done in industry.

Advice to applicants

You should not attempt this course without adequate knowledge. You need to have taken T202 *Analogue and digital electronics* (or one of its predecessors, T283 or TS282), or to have equivalent knowledge from elsewhere, such as an HNC or HND in electronics. There is a great deal of manipulation of Boolean algebra expressions, so you should also be sure that you have the necessary mathematical skills, to about the level of TM282 *Modelling with mathematics: an introduction* or MST121 *Using mathematics*. We also recommend taking at least one other course at Level 2 in electronics or a related area: T223 *Microprocessor-based computers* would be particularly useful. Your Regional Centre will be able to tell you where you can see reference copies of the recommended courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you took one of the the discontinued courses T283 or TS282 instead of T202, you are advised to do some additional preparation before beginning T323, for example by studying Block 3 of T202.

Preparatory work

It would be useful to revise the principles of logic design: you could look at Block 3 of T202 *Analogue and digital electronics*.

If you are disabled

The computer work includes building very detailed diagrams and waveforms on the screen, using a combination of mouse movements and keyboard stokes, so good visual acuity and manual dexterity are needed. Some difficulties can be overcome by means of software and hardware. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material

C. R. Roth Jr. *Fundamentals of Logic Design*, West Publishing Minnesota, 4th edition
Project guide
Study guide
Computing booklet
MCE array design manual

Software

All the software you need will be sent to you.

You will need

Computer

For the practical work you must have access to a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are five tutor-marked assignments (the last is a project report) and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T323 this rule can apply to one assignment but not to the project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the professional engineering institutions. You can find out more in our Recognition Information leaflet:

3.3 *Membership of professional bodies: the professional engineering institutions*

You can get this from your Regional Centre.

T323

ENGINEERING MECHANICS: SOLIDS AND FLUIDS

This is a 30-point course at Level 3, with no residential school.
Use of a personal computer is optional.

The course

Mechanical engineering is, ultimately, about design: the design of devices such as bridges, cars, power stations, ships and aircraft. In order to achieve design goals today's mechanical engineers are expected to be familiar with subjects ranging from metallurgy to microelectronics, but their primary area of expertise is still engineering mechanics.

Solid and fluid mechanics have many applications. The designer of a car or spacecraft must give it the means to move at different speeds in different directions; the designer of a bridge must make sure that it can support the loads applied to it. The engineer may be trying to design for a level of performance not yet achieved, or to produce a specified performance at the lowest cost. Engineering mechanics is about the principles of mechanics and their application in achieving this sort of design goal. The fundamental principles are introduced in T235 *Engineering mechanics: solids*. In T331 the principles are extended, making it possible to introduce many new, more advanced and interesting problems. The essence of the course, therefore, is the principles of engineering mechanics and their application to design in the hands or at least in the mind of the creative engineer.

The course is in five sections, the first four introducing concepts and applications and the last devoted to revision. The subject-matter includes solid and fluid mechanics but excludes thermodynamics.

The introductory section considers various principles and problems, including control of motion, that arise from the design of mechanisms and machinery. It leads to the study of kinematic principles by graphical and vector methods. Once the required motions are established the forces must be considered, bringing in the study of kinetics which, combined with kinematics, gives dynamics. There is some revision of the more elementary methods, interpreting them from a more advanced point of view, and new methods and concepts are introduced.

The second section is devoted to structural analysis. Again, the basics (as introduced in T235) are re-examined in a more advanced light and new topics are brought in, including beam shear and beam deflections, instability, buckling and indeterminacy. This points the way towards designing the best structure with the most economical use of material.

The static, dynamic or vibrational behaviour of a solid object or structure often depends on the forces exerted by fluids – most often, of course, the atmosphere or the sea, the subject of the next section. This section is about the problem of estimating forces exerted by fluids on immersed solid objects, for example vehicles, wind forces on buildings, wave forces on offshore structures and pipelines. The emphasis is very much on the interaction of solids and fluids.

Vibration problems are a widespread plague of practical mechanical engineering, and often the cause of unexpected failures. The fourth section is devoted to analysis of one-, two- and multi degree of freedom systems, and introduces concepts such as natural frequencies, mode shapes and related topics. This provides the essential physical understanding and mathematical tools required to anticipate vibration problems at the design stage, or to diagnose and rectify them retrospectively.

The last part of the course consists of revision, including worked solutions to the specimen examination paper. This course is concerned with realistic problem-solving in a design context, so you must be prepared to set about solving problems yourself, not just to read.

Advice to applicants

This course is not suitable if you have no experience of solid mechanics and you are strongly advised to study T235 *Engineering mechanics: solids* first. Your Regional Centre will be able to tell you where you can look at reference copies of that to see what is required, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. Even if you have covered the material in T235 before, it would be wise to consider taking that course first because of the very thorough grounding it gives in widely applicable fundamentals.

You will also need some mathematics, at least to the level of TM282 *Modelling with mathematics: an introduction*, although the emphasis is very much on physical understanding rather than on mathematics itself. You should have some experience of geometry, algebra, calculus, trigonometry and 'mechanical' drawing, as in T235.

You will find the text heavily loaded with examples and questions, and will spend most of your time working on those rather than just reading. There is no other way to learn mechanics.

Preparatory work

An interesting view of some aspects of the subject is given in *Structures* by J. E. Gordon (Pelican).

It would also be useful to look at T236 *Introduction to thermofluid mechanics*. T331 has a strong emphasis on the relationship between solids and fluids, so T236 is a helpful, though not necessary, preparation.

If you are disabled

The course requires the interpretation and construction of many diagrams, and there are no recordings of the study texts. Transcripts of all the television programmes and audio cassettes can be provided. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material

Fifteen study texts
Course guide
Notes to accompany the audio cassette and television programmes

Broadcasts and cassettes

Two television programmes
One audio cassette

You will need

Television
Audio cassette player
A video recorder would be useful
Scientific calculator
Set of drawing instruments; simple ones will do although it is more rewarding to work with the best tools you can afford.

We are exploring the possibility of augmenting the supplementary material in 1997 with some optional computer-based applications, but no decision has yet been made.

Assessment

There are four tutor-marked assignments, five computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T331 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body. It

is included in degree profiles that are acceptable for chartered engineer membership of many of the professional engineering institutions, including the Institution of Mechanical Engineers and the Institute of Marine Engineers. It is also recognized by the Institute of Physics. You can find out more in our Recognition Information leaflets:

3.3 Membership of professional bodies: the professional engineering institutions
3.5 Membership of professional bodies: Institute of Wastes Management
3.6 Membership of professional bodies: the Institute of Mathematics and its Applications
3.7 Membership of professional bodies: the Institute of Acoustics
3.8 Membership of professional bodies: scientific institutions

You can get these from your Regional Centre

For the future

T331 may not be available in its present form after 1997. We are considering either continuing it after that or revising it, but there is no guarantee at the moment that it will be presented in 1998.

T332
HEAT TRANSFER: PRINCIPLES AND APPLICATIONS

This is a 30-point course at Level 3. It has no residential school and requires no computing equipment.

The course

The course provides a thorough understanding of the principles of heat transfer and develops the skills required to carry out engineering analysis and design of thermal systems. It covers basic principles with the necessary mathematical background. Throughout the course there is considerable emphasis on the application of the subject, with many problems drawn from practical engineering situations. The scope and limits of various methods of heat transfer analysis are covered, developing skills appropriate to modern industrial practice. By the end of the course you should be able to:

- Recognize the heat transfer modes in any given situation.
- See the most appropriate model of the situation and some of its limitations.
- Select and evaluate appropriate heat transfer coefficients from reference sources.
- Make some design decisions about the selection and specification of practical industrial heat exchanges.

The main texts are arranged in nine blocks, most relying heavily on the two set books.

Block 1 introduces the three modes of heat transfer: conduction, convection and radiation. Its main aim is to develop your ability to identify the modes of heat transfer present in any thermal situation. The relationship between thermodynamics and heat transfer is covered, together with the application of the energy balance method of analysis.

Block 2 develops the principles of conduction heat transfer. It considers one-dimensional, two-dimensional and transient heat transfer problems, and different methods of solution.

Block 3 introduces the concepts of velocity, boundary layers, thermal boundary layers and convection transfer equations. Empirical relationships are presented in the form of dimensionless convection heat transfer correlations.

Block 4 begins with the finite difference method of solving conduction heat transfer problems. It shows how this technique greatly helps analysis and makes it possible to tackle practical heat transfer problems that would otherwise be difficult or impossible. The accuracy of finite difference solutions is questioned.

Block 5 introduces the mechanisms of boiling heat transfer and condensation, including boiling curves, nucleate, convective and other types of boiling and various forms of condensation, such as laminar film and dropwise.

Block 6 is about the fundamentals of radiation heat transfer, including black-body radiation; radiation from real materials, absorption, reflection and transmission of radiation; radiation exchange between surfaces. View factor charts and tables, shape factors and numerical methods of solutions are introduced.

Block 7 develops earlier work on combined heat transfer modes. It introduces heat transfer from extended surfaces, including fins of uniform and non-uniform cross-sectional area; fin performance; and heat transfer enhancement.

Block 8 gives an introduction to practical industrial heat exchangers. Basic design procedures are considered in some detail, and types of exchangers such as the shell-and-tube are described.

Block 9 leads you through a design study of a shell-and-tube heat exchanger in order to demonstrate a typical design procedure used in industry.

Advice to applicants

The course should be valuable to anyone who wants an introduction to heat transfer or who is considering the analysis and design of heat transfer systems. You will need to be familiar with the laws of thermodynamics and the analysis of simple thermodynamics systems. You will be doing a good deal of arithmetic manipulation, requiring confident use of a calculator. You could look at T236 *Introduction to thermofluid mechanics* to get an idea of the level required. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

The course includes detailed charts, diagrams and lengthy equations, and there are no recordings of printed materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Nine study texts
Formula booklet

You will need to buy

Set books

F. P. Incropera, D. P. DeWitt *Introduction to Heat Transfer*, 3rd edition, John Wiley, £18.50

G. F. C. Rogers, Y. R. Mayhew *Thermodynamics and Transport Properties of Fluids (SI Units)*, 5th edition, Blackwell Publishers, £4.50

(1996 prices)

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T332 this rule can apply to one tutor-marked assignment and one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.3 Membership of professional bodies: the professional engineering institutions
3.5 Membership of professional bodies: Institute of Wastes Management

You can get these from your Regional Centre

For the future

This course will be presented for the last time in 1998.

T333
FAILURE OF STRESSED MATERIALS

This is a 30 point course at Level 3. It has no residential school and requires no computing equipment.

The course

When materials are put under stress in structures or machines they sometimes fail, with tragic and costly results. To forestall such failures engineers should know all the ways in which load-bearing materials can fail. This course reveals the principal modes of failure in stressed materials and the conditions in which each mode may occur.

The course consists of a sequence of case studies, each presenting a different mode of failure. The modes of failure considered all involve either fracture or an excessive change of dimension, with the main emphasis on modes of slow and fast crack growth; the theory of fracture mechanics is presented to describe these events. Most of the case studies are histories of failure investigations that try to discover the mode of failure and make recommendations to avoid another failure. The other case studies are about design, with the object of prescribing the dimensions of a product to meet given loading requirements without failure. By considering a wide range of useful materials in a variety of loading conditions, the course shows how the occurrence of failure can be predicted. The skills are applicable both to the design of load-bearing artefacts and to the 'post-mortem' analysis of mechanical failures.

The course draws on the complementary disciplines of mechanics and materials science, and it is designed for the student who has some knowledge of both. From mechanics comes information about loads and deflections in simple components, while from materials science comes information about the make-up and properties of constructional materials.

The first case study presents the failure of a riveted joint in a freight container. It reminds us that nothing is unbreakable and that 'overload' failures occur when the finite strength of an apparently unflawed component is exceeded.

The second case study introduces a flawed object, a pressure vessel that has an unforeseen crack and explodes during proof testing. This establishes a need for a mechanics of cracked bodies, and the theory of linear, elastic fracture mechanics is presented and used to account for the 'brittle fracture' of the vessel.

The third case study, about the failure of a critical component in a colliery lift mechanism, demonstrates that not all crack growth occurs rapidly. Analysis of the debris reveals that over the years the component became deeply cracked by 'metal fatigue' leading eventually to failure by brittle fracture. It also becomes apparent that the original cause of fatigue was 'wear' of a badly designed bearing, and this too is identified as an important mode of failure.

The fourth case study introduces another mode of slow crack growth, so-called 'static fatigue'. The case considers the incidence of fracture in ceramic grinding wheels during proof testing, and we see that with brittle materials there is a large scatter in strength that must be taken into account during design.

The next case study is about slow crack growth in metals by the process of 'stress corrosion cracking', which occurs under the conjoint action of stress and a hostile chemical environment.

The last case study describes the design of a polyethylene pressure pipe for carrying natural gas, showing that it is necessary to take account of the possibility of failure by the processes of slow crack growth called 'creep rupture' and 'environmental stress cracking'.

The last part of the course is a project in which you are challenged to solve a problem. The nature of the problem changes from year to year, but it is either a failure investigation or a design. No new examinable material is introduced here, but you will need many of the principles taught in the course to solve the problem presented and produce a report.

Advice to applicants

The course is particularly appropriate for students who have an interest in mechanical, civil, chemical or materials engineering. You must have a certain level of knowledge in both materials and mechanics. In particular you are expected to be able to:

- Understand strain and elasticity, including torsional and bending stresses in materials and components.
- Follow mathematical derivations using geometry, algebra and calculus.
- Distinguish between elastic and plastic strain.
- Appreciate static loads on structures in terms of point loads, bending moments and torques.
- Describe the microstructure of metallic alloys, simple polymers, ceramics and composite materials, and how the mechanical properties of these materials depend on the nature of their microstructure.

T203 *Materials: engineering and science* provides an excellent preparation for the course, and T235 *Engineering mechanics: solids* gives a good background in mechanics. Your Regional Centre will be able to tell you where you can see reference copies, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you have not taken the two recommended Open University courses you are strongly advised to send for either (or both) of two self-test papers on mechanics and materials science. Please write to the T333 Course Manager, Faculty of Technology, The Open University, Walton Hall, Milton Keynes MK7 6AA, enclosing an A4 or A5 stamped addressed envelope. These papers will give you advice, based on your performance in the test, about whether you are likely to complete the course successfully.

If you have any doubt about your ability to take the course please seek advice from your Regional Centre.

If you are disabled

This course is not recommended if you have impaired sight or manual dexterity and the course material is not available on audio cassette. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Seven study texts

Broadcasts
Eight television programmes

Home kit

Visual examination is an important part of failure analysis – it may reveal the mode of failure – and you will be lent a kit to help you gain experience in it. These are plastic replicas of fracture surfaces to be examined with a watchmaker's eyeglass (also supplied), and stereo photographs of fracture surfaces at high magnifications. There is also a polariscope and loading frame with which you can observe stress distributions in photoelastic specimens; it is also used to measure the fracture toughness and the speed of propagation of cracks in a glassy thermoplastic.

Outside the UK

Because of restrictions on exporting the kit, this course is not available outside the UK.

You will need

Television (preferably colour)

Assessment

There are six tutor-marked assignments, a project and an examination. The University

expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T353 this rule can apply to two assignments but not to the project. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of T353 overlaps with the discontinued course T351, you can count only one of the two towards a BA or BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body. You can find out more in our Recognition Information leaflets:

3.3 *Membership of professional bodies: the professional engineering institutions*
3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*
3.5 *Membership of professional bodies: Institute of Mathematics and its Applications*
3.7 *Membership of professional bodies: Institute of Acoustics*

You can get these from your Regional Centre.

For the future

T353 will be presented for the last time in 1998. Plans for a new course in the same subject area are being considered.

T354

INSIDE ELECTRONIC DEVICES: ENGINEERING OF INFORMATION TECHNOLOGY

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

Computer memories, CDs and magnetoptic disks, oxygen sensors, flat-screen displays, fibre-optic links: these devices are used in many information systems, storing, gathering, displaying and transmitting data. How do they work? How are they made? What is their potential? What are their limitations? Engineers need to understand the answers to questions like these if they are to use such devices efficiently and effectively.

The course looks at the relationship between electronic properties and the devices of information technology. The term 'information technology' in the context of this course embraces the electronic world in general from sensors, like those that diagnose engine performance, to random access memory, which stores instructions about what to do with data from a sensor. The course also deals with some of the diverse hardware. There are important links between the principles by which a device functions, the properties of the materials it is made of and the processing that ensures appropriate performance. For instance, the magnetic particles in the film on floppy disks have carefully tailored composition, shape and orientation in order to achieve a high density of information.

You will investigate electronic phenomena such as dielectric behaviour, magnetism and semiconductors, and their interaction with thermal and optical properties. Algebraic models that describe the behaviour of various components and devices are used to provide a quantitative description where appropriate. For the design-oriented project at the last third of the course you may be offered a choice so that you can pursue a more specialist line. You will make assumptions, propose solutions and prepare a technical report, all with guidance from your tutor.

Advice to applicants

You must be familiar with basic electrical ideas and principles in an algebraic context. The University's technology foundation course (T102) followed by a Level 2 course such as T202 *Analogue and digital electronics* or T203 *Materials engineering and science* (or equivalent knowledge from elsewhere) would be a good starting-point. Or you could be suitably prepared by science faculty courses such as the science foundation course (S102), S271 *Discovering physics* and S272 *The physics of matter*. The T354 study guide includes material designed to ensure that you are sufficiently familiar with important basic knowledge.

Preparatory work

Make sure that you are familiar with Windows and appropriate word-processing and spreadsheet software.

If you are disabled

The texts have a high proportion of graphical material, some detailed and in colour, and work with diagrams is an important part of the course. You must be able to use a computer. If you need to use a computer with adaptations, please consult the Office for Students with Disabilities, The Open University, PO Box 79, Walton Hall, Milton Keynes MK7 6AR. Recordings of printed course materials will not be available in 1997, the course's first year. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Two study texts
Study guide
Project guide

Broadcasts and cassettes
Three television programmes
One video programme
Seven audio cassette programmes

Software
Software is supplied on either 3.5-inch or 5.25-inch disks; you will be asked which you need.

You will need

Television
Audio cassette player
Video cassette player (VHS)
Computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre), with Microsoft Works or an acceptable alternative. We hope to provide Works at a low cost, and we will send you more information when you register for the course.

Assessment

There are four tutor-marked assignments (two are associated with the project) and an examination.

Awards

T354 can count towards either a BA or a BSc degree. We expect that it will be designated *S*, which means that it can weight your degree towards a BSc.

Related courses
Because the subject-matter of T354 overlaps with the discontinued courses T201 and T253, you can count only one of the three towards a BA or BSc.

Professional recognition
We hope that this course will in some circumstances help you to gain recognition from certain professional bodies in the technological and applied sciences. You will be able to find out more from our Recognition Information leaflets, available from your Regional Centre.

T356

MANUFACTURING TECHNOLOGY

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This course is about manufacturing products from the point of view of the materials engineer. Its aims are:

- To introduce not just the detail of processing materials but also the broader issues associated with the choice of a particular process and how it works in a manufacturing environment.
- To help you to develop the independent study skills that will allow you to pursue personal research activities.

In the first half of the course your study will be in the following areas:
Shaping strategies Revision of materials and properties relevant to processing; a brief outline of product design followed by an introduction to methods of choosing processes.
Manufacturing processes The details and generalities of the four principal processing groups: casting, forming, cutting and joining.
Quality control and process control Principles and practice of quality control, with an emphasis on statistical process control.
Manufacturing strategies Broad issues associated with decision-making in manufacturing (including costing).
Most of this study is based on the text *Manufacturing with materials*, with extensive use of computing and video materials, but there will also be opportunities to use an offprint collection with a wide range of readings in all aspects of manufacturing technology.
The second half of your study will be taken up by a project, which you will choose and develop with help and guidance from your tutor. There are several topics to choose from, each with its own outline and selection of readings, ranging from new developments in particular processing techniques or integrating choice of process into the product design cycle to strategic decision-making in engineering manufacture. You will use computer search tools to make bibliographic searches on the Internet, and you will need to visit libraries to find documents for your project.
An advanced computer conferencing system that can carry both information and documents will connect you with your tutor and with other students. From your project you will produce a dissertation that takes the place of an examination.
We shall be using the electronic conferencing system for tutorials, and you will be able to keep in touch with your tutor through electronic mail.

Advice to applicants

You are expected to have a solid grounding in most aspects of basic physical science and materials. In particular you should be able to:

- Recognize the names of most common metals, ceramics and polymers.
- Distinguish between metals, ceramics and polymers in terms of their atomic and molecular structure.
- Relate the atomic-level structure and microstructure of a solid material to its physical properties.
- Describe the main solid state deformation processes for materials and distinguish between elastic, plastic and viscoelastic deformation.
- Identify, from a curve of engineering stress against engineering strain for an elastic material, the Young's modulus, yield stress and tensile strength of the material.
- Account for the phenomena of work hardening, strain hardening, recovery and recrystallization in terms of atomic level and microstructural changes occurring in crystalline materials.
- Describe the mechanisms of creep, stress relaxation and fatigue in materials.
- Use phase diagrams and transformation maps to predict how the microstructures of materials change with temperature and time.
- Outline the principal degradation mechanisms applicable to different classes of materials.
- Explain the significance of differential calculus; recognize correct definitions of the standard deviation, mean and range of a set of data and apply similar numeracy skills.

You could gain these skills and knowledge from T102, the technology foundation course, and T203 *Materials: engineering and science*. Your Regional Centre will be able to tell you where you can see reference copies of these courses, or you can buy selected materials from Open University Educational Enterprises, 12 Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY.

If you are disabled

The course uses complex diagrams and graphs and there are no recordings of printed materials. The project usually requires access to libraries and other sources of information, but we can make alternative arrangements if you cannot use these sources. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Course manual
Course text *Manufacturing with materials*
Offprint collection
Project manual
Computing guide
Video cassette notes

Broadcasts and cassettes
Two video cassettes

Software
Course software and general-purpose communication software

You will need

Video cassette player (*VHS*)
Computer and modem as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).
To use the modem you will need a telephone line fitted with a British Telecom 600-series jack socket.

Assessment

There are three tutor-marked assignments, two computer-marked assignments, and a project that takes the place of an examination. You may be asked to attend an oral examination on the project. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T356 this rule can apply to one tutor-marked assignment *or* one computer-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from professional bodies including the Institute of Materials, the Institute of Hospital Engineers, the Institution of Nuclear Engineers and the Institute of Plant Engineers. You can find out more in our Recognition Information leaflet:

3.3 *Membership of professional bodies: the professional engineering institutions*

You can get this from your Regional Centre.

T363

COMPUTER-AIDED DESIGN

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

This course introduces and develops your awareness of the principles of computer-aided design (CAD) and a range of applications of CAD systems in design. By the end of it you will have a broad understanding of how computers can be used to aid the process of design, and some fundamental knowledge of the principles of using computers to model various aspects of designs. You will have had some experience of using relatively simple yet powerful CAD software, though the course does not set out to provide comprehensive training in the use of any particular CAD system. Instead, it teaches principles that are relevant to all CAD systems and is deliberately designed to emphasize principles and underlying ideas. The intention is to give you a fundamental understanding of CAD that will last, even in this rapidly changing field. The aims of the course are:

- To teach some of the principles of computer-aided design and computer graphics.
- To give you some practice in applying the principles in design exercises.
- To illustrate the application of those principles in professional CAD packages used in engineering, electronics and building design.

The course is presented in three parallel but interdependent streams: text, computer and video.

Text
The text stream begins with a basic introduction to design and computers, and ends by considering new directions in the application of artificial intelligence and expert systems in CAD and some of the implications of CAD. There is a glossary of terms and concepts that you are likely to meet in computer graphics and computer-aided design. Much of the text is in the set book, *Principles of Computer-aided Design*. It was specially written for this course and deals with the ways in which tasks and procedures in design can be formalized, how geometric and other properties of designed objects can be represented, and the significance of computer aids for the theory and practice of design. Much of the book is concerned with the mathematical foundations of computer modelling, but the study guides to the book's chapters ensure that even those whose mathematics are weak or rusty are brought to a sufficient level of understanding. The topics include mathematical tools; assemblies; graphics; wireframe, surface and solid modelling; kinematic analysis; logic simulation; building geometry; hidden-line and hidden-surface removal; geometry in motion.

Computing
The computing stream consists of a set of structured exercises known as CADPAC 1–7, mainly concerned with CAD applications. The application areas chosen are in architecture, electronics and mechanical engineering design. Most of the exercises are based on original teaching software developed at the Open University for this course, but CADPAC 4 gives access to a commercial two- and three-dimensional package called SilverScreen. Some of the computer exercises also provide computer-assisted tutorials in the basic principles that are introduced in the textbook.
The CADPAC software starts with introductory exercises, such as a painting system, for those who may be quite unused to working with a computer. Confidence is built up during the kitchen design module with its easy-to-use filing system. Then come the basics of computer graphics, such as representations and transformations. Three-dimensional modelling, Bezier and B-spline curves, finite element analysis, PCB design and layout are all taught in an approachable fashion. The modules include exercises in electronics and engineering design as well as the SilverScreen modelling system. The stream ends with an expert systems shell designed to teach the basic principles of predicates, rules, forward and backward chaining.

Video
The video stream helps to teach some of the basic principles and demonstrates professional CAD systems in areas such as draughting, modelling, analysis and graphics. Accompanying notes offer exercises and comments to stimulate active use of the video material. As well as demonstrations of CAD systems in use, there are specially-designed studio sessions and interviews with designers who use CAD. The CAD systems shown on video include design work for the Citroen AX car and the North Terminal at Gatwick Airport, the Acropolis 2-D draughting system, the Ferranti CAM-X system for the design of gearboxes, systems for geometric modelling and finite element analysis, an energy cost index analysis program, and computer-aided design techniques for the Mongstad oil refinery. A video illustrates the finite element method applied to a linear stress analysis of a wheel-hub for the 1994 Lola Indy car. Other techniques shown on video include hidden-surface removal, ray tracing and shadows, data-glove and handset, orbital manoeuvres at NASA, optimization and physical intuition interfacing.
These three parallel streams run throughout the course and you are expected to draw together the material from all of them. A typical study period might include chapters from the textbook on representation and graphical techniques, computer exercises on architectural plan layout and video study of basic graphics principles and draughting systems.

Advice to applicants

You are not expected to be familiar either with the design process or with computers; the course is written for students from a wide variety of backgrounds. Some experience in reading mathematical notation, particularly the mathematics of matrices and solid geometry, would be an advantage.

Preparatory work

We recommend as preparatory reading:
S. Pugh (1991) *Total Design: Integrated Methods for Successful Engineering*, Addison-Wesley (a concise introduction to the total design process)
W. Luzadder, J. M. Duff (1993) *Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production*, Prentice Hall (a good technical drawing book)

If you are disabled

Course material is not at present available on audio cassette, but there are transcripts of the video programmes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Three study texts
Study guides to the set book
Notes to accompany the video cassettes
Six video cassettes
Software

You will need to buy

Set book
J. Rooney, P. Steadman (1987) *Principles of Computer-aided Design*, UCL Press, £17.95 (1996 price)

You will also need

Television
Video cassette recorder (VHS)

Computer
There is a lot of computing in the course (at least 70 hours) and you must have access to a computer as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).
You are responsible for satisfying yourself that your access to a computer is adequate and that the computer itself, including the maths co-processor, is suitable. To make sure, you can get a test disk and a set of guidance notes on computer hardware with special reference to the need for a maths co-processor by writing to The T363 Course Manager, Faculty of Technology, The Open University, Walton Hall, Milton Keynes MK7 6AA. Please say which size disk you need.

Assessment

There are four tutor marked assignments and an examination.

Awards

This course can count towards either a BA or a BSc degree. It is designated *F*, which means that it is equally appropriate to either.

Professional recognition
This course can in some circumstances help you towards a professional qualification. It is recognized by many of the professional engineering bodies and by the Institution of Analysts and Programmers. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*
3.5 *Membership of professional bodies: the Institute of Wastes Management*
3.7 *Membership of professional bodies: the Institute of Acoustics*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

For the future

This course will be presented for the last time in 1998.

T395

MECHATRONICS: DESIGNING INTELLIGENT MACHINES

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

The design of intelligent machines is a new subject area that has recently emerged from the practical need for machines that can work autonomously under conditions of some uncertainty, that is, in situations where unpredictable events occur. This course takes you very close to uncharted research territory. The course includes more material about information processing and artificial intelligence than about mechanical or electronic engineering. By the end of it you should be able to:

- Communicate with both experts and novices in the field, using appropriate terminology.
- Understand books and articles about intelligent machines, and continue to develop the knowledge and skills you have acquired.
- Take part in teamwork specifying and designing intelligent machines.
- Recognize and assess opportunities for the use or development of intelligent machines.

The central element of the course is SmartLab, eight activities using an integrated set of computer programs and a home experiment kit. It gives you exciting opportunities to perform some advanced experiments on your computer screen and on your kitchen table. The topics taught include communications, pattern recognition, neural networks, scheduling and search, rule-based systems, fuzzy logic, blackboard systems and intelligent control.
The course is organized in five sections:
Introduction
Perception
Cognition
Execution
Integration
Volume 1 of the textbook, *Perception, Cognition and Execution*, gives background information about intelligent machines and their main functional subsystems: perception, cognition and execution. It also includes a survey of the concept of architecture and describes approaches to designing mechatronic products.
Volume 2, *Concepts of Artificial Intelligence*, presents concepts and techniques of artificial intelligence that are applicable in practical situations. You will be expected to use these concepts and techniques in design and analysis exercises and in SmartLab.

Advice to applicants

This course will be of interest to anyone who wants to understand the principles and methods applicable to mechatronics, or to develop the skills that are needed to participate in the specification and conceptual design of intelligent machines.
Although the course provides background material in mechanical and electrical engineering, information systems, communication and classical control, you will find it difficult to cope unless you already have some knowledge in at least one of those areas. You are not expected to have any knowledge of artificial intelligence.

If you are disabled

If you cannot follow material presented on screen, including computer graphics, you will miss essential parts of the course. If you have difficulties with manual dexterity you might need help to assemble the home kit. There are no recordings of printed course materials but there are transcripts of all the video cassettes. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Two study texts
Five study guides
Eight SmartLab texts

Cassettes
Four video programmes

Software
You will receive SmartLab software, which runs under Microsoft Windows (version 3.1 or later).

Home kit
There is a kit to be used with the SmartLab hardware.

Outside the UK

At present you cannot take this course outside the UK, but we hope that difficulties to do with exporting the kit will be resolved for 1997. Please ask your Regional Centre for the latest information.

You will need to buy

Batteries to use with the SmartLab hardware.

You will also need

Video cassette player (VHS)

Computer
For the practical work you must have easy access to a computer as described in the leaflet *Personal Computing for Undergraduate Courses 1995/96* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments, four computer-marked assignments and an examination. The computer-marked assignments will not count towards your course result. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T395 this rule can apply to one tutor-marked assignment. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances help you to gain recognition from a professional body such as the Institution of Analysts and Programmers. You can find out more in our Recognition Information leaflets:
3.3 *Membership of professional bodies: the professional engineering institutions*

3.7 *Membership of professional bodies: Institute of Acoustics*
3.11 *Membership of professional bodies: other bodies*
You can get these from your Regional Centre.

T320

ARTIFICIAL INTELLIGENCE FOR TECHNOLOGY

This is a 30-point course at Level 3, with no residential school.
It requires a personal computer.

The course

Artificial intelligence – trying to make computers behave more like human beings – has given rise to some useful software techniques. This course is for those who want to study the principles of these techniques and some of their applications in technology. It emphasizes the development and application of useful software tools for solving technological problems, and does *not* deal with the philosophical, biological or psychological implications of artificial intelligence.
The course is divided into three parts: knowledge-based systems, neural networks, and a project in which you apply knowledge-based system and neural-network techniques to a technological problem. Smaller examples appear throughout the course, and software is provided so that you can try them out for yourself.
Knowledge-based systems The topic is based on *Knowledge-Based Systems for Engineers and Scientists* by Hopgood, CRC Press. (This text and the book by Picton – see below – are both provided as part of the course materials.) The book and its associated study guide show how knowledge can be represented using rules, objects, and other techniques. Rules can take on a variety of guises from simple 'if … then …' statements to complex statements that take account of uncertainty. Objects provide a convenient programming style for handling complex information. The Prolog language and fuzzy logic are also introduced. All these techniques are demonstrated with the supplied software. This part of the course also introduces the idea of machine-learning: computer programs that can alter their knowledge in the light of experience. Various techniques for achieving this are described. The most important of these are neural networks, which form the next part of the course.
Neural networks This topic is based on *Introduction to Neural Networks* by Picton, MacMillan Press. The book and its associated study guide explain the functioning of many of the currently used neural networks such as the multi-layer perceptron and the Kohonen network, as well as some of the more specialized networks such as the Hopfield network. Each chapter describes a network and gives simple examples of how it can be used. The supplied software allows you to build, train and test your own networks.
The project In this part of the course you will carry out a small project, using the techniques that you have learnt to tackle a practical technological problem. You might, for example, be asked to investigate the automatic recognition of hand-written postcodes. You will be expected to develop your own prototype software, using the packages supplied, and to write a project report. For your guidance, the course texts describe a variety of applications of knowledge-based systems and neural networks under the broad headings of interpretation, diagnosis, design, selection, planning and control.
In 1997 we intend to offer some students an 'electronic tutor' instead of (not as well as) the usual tutorial arrangements. You would communicate with the 'electronic tutor' through a modem, over a computer network. If you are interested in trying this out, please write to the T396 Course Manager, Technology Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA. Please write before 30 September, and explain why you would like to be considered.

Advice to applicants

No specialist knowledge of mathematics is required, but you are expected to be numerate and to be competent at basic algebra. Supplementary materials are provided that explain the mathematical concepts in the course. Similarly, no specialist knowledge of computing is required, but you are expected to be competent at using a personal computer. You will be required to program your computer using the supplied software. Instructions for using the software packages are provided.
You are advised to gain at least 60 points from Open University courses at Level 2 or Level 3 before undertaking this one.

Preparatory work

The most useful preparation would be to make sure that you are competent at using Windows and DOS on your computer.

If you are disabled

If you cannot follow computer graphics on the screen you will miss essential parts of the course. Severely impaired sight would make it difficult to cope with the diagrams in the two books, which are many and sometimes complex. There are no recordings of printed course material. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

Printed material
Two study texts
Three study guides
Course guide
Two software handbooks
Project guide

Software
Flex, a knowledge-based system package that includes Prolog
Neuralworks, a neural network package
Examples and exercises
Data for the project

You will need

For the practical work you will need access to a computer and a modem as described in the leaflet *Personal Computing for Open University Courses 1996/97* (available from your Regional Centre).

Assessment

There are four tutor-marked assignments, and a project report at the end of the course that takes the place of an examination. You may be asked to attend an oral examination on your project. The University expects you to complete all the assessment because it is an essential part of the teaching. But to help you if you unavoidably miss or perform badly in an assignment some courses allow you a 'substitution score', calculated as a weighted average of all your scores for the course. In T396 this rule can apply to one assignment but not to the project report. You will be given more detailed information when you begin the course.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition
This course can in some circumstances count towards a degree that confers eligibility for graduate membership of the Institution of Electrical Engineers or the Chartered Institution of Building Services Engineers. You can find out more in our Recognition Information leaflet:
3.3 *Membership of professional bodies: the professional engineering institutions*
You can get this from your Regional Centre.

T401

TECHNOLOGY PROJECT

This is a 60-point course at Level 3.

The course

The technology project offers you an opportunity to carry out a supervised project in any area or combination of areas covered by the Faculty of Technology. Projects have been successfully introduced in several Open University courses, but in T401 you work solely on one project chosen to reflect your own interests. By the end of the course you should be able to:

- Organize yourself and your work in order to achieve a specified goal within a strict time limit.
- Gather, analyse and evaluate material relevant to your project, in order to increase your understanding and awareness and your ability to generate ideas.
- Produce a written report that clearly and concisely communicates the content of the project.

The project
The projects in T401 usually have a practical aim in view. They may result in design proposals or specifications for a system or artefact, in policy proposals, or in the studies relevant to such practical ends. *They are not expected to be research projects with pursuit of knowledge as the main aim, as postgraduate research for a higher degree would be.*
The breadth of subjects covered in completed projects is very wide and spans the academic discipline interests of the faculty. These include electronics, materials, engineering mechanics, design and systems. Several kinds of activity can be the basis of a suitable project, whether it is concerned with an investigation of an organization or system or a design specification for a mechanical or electrical component.
Your project must draw on knowledge gained from courses in one or several of the five disciplines in the Technology Faculty, and may also draw on knowledge or experience you have gained elsewhere. Academic acceptance of your project depends on its feasibility and scope, and you will have guidance on this during the application process. Relevant preliminary study is occasionally advised; otherwise, only a lack of practical requirements such as necessary facilities, a suitable local tutor or an internal examiner may mean that a proposal has to be reconsidered or rejected. Proposals that are not based on Faculty of Technology courses are the most vulnerable.

Choosing a project
Usually, students suggest their own project topics or areas. If you have no topic in mind, you should consult the technology staff tutor at your Regional Centre or the T401 Course Manager, Faculty of Technology, Walton Hall, Milton Keynes MK7 6AA. It may be possible to offer suggestions for a project based on areas of interest to you. Either way, the topic is then developed, in consultation with a prospective tutor, into a feasible project proposal to be forwarded to the course team for approval.
Your project must have a technological content within the topics covered by the Faculty of Technology and must be consistent with work at honours degree level. It must also be compatible with your previous studies or experience, so that you can get the most out of doing it. If your proposal is judged to meet these requirements, it is usually possible to proceed to a formal project proposal.

Advice to applicants

T401 was designed to be the last course in a 480-point honours degree. Although the Faculty does not consider T401 appropriate to a 360-point degree, we recognize that some students might want to include it in a 420-point honours degree.
Applications for 1998 will be accepted from students who:

- Already hold at least 360 points
or
- Have at least 300 points and are taking courses worth 60 points in 1997. If you do not pass these courses or do not have 60 points at Level 3, you will not be able to take T401 in 1998.

You should have at least 120 points from courses supervised by the Faculty of Technology. In order to obtain the maximum benefit from the technology project, you are strongly advised to take at least one Level 3 technology course of direct relevance to your proposed project during the year in which you are registering for T401 (that is, in the year before doing a project). For systems projects, for example, this would be T301 *Complexity, management and change: applying a systems approach*.
T401 is designed to be the culmination of your OU studies. This and the demanding nature of the course mean that it is not appropriate to undertake another course simultaneously with it.
All T401 projects are comparable to those in the final year of an honours degree at a conventional university. This has a number of implications:

- The amount of independence and initiative expected of you will be appropriate to a course at this level.
- Projects must draw on specialist knowledge and skills – such as interpretation of data, analysis of written material and the planning and production of structured reports – gained from other Faculty of Technology courses (including courses at Level 3) and, if appropriate, from other educational or work experience.
- You may be advised to pursue a specified course of study before starting a T401 project. This may happen if it is considered that you are inadequately prepared to embark on the proposed topic to the depth and breadth consistent with an honours-level project.

As there are only about 100 places on this course, students will be selected according to the academic acceptability and feasibility of their project proposals.
Application for T401 takes place from 1 January to 31 March *in the year before study*. If you want to be considered for T401 (for 1998) you should write, during this period, to The Open University, PO Box 72, Milton Keynes MK7 6AQ asking for an application form.
At this stage you will be asked for your project proposal, which need only be in outline form as a tutor will be appointed to help you produce a formal proposal. This appointment is not a guarantee of acceptance; your project must meet the criteria explained in *Choosing a project*.
You will have a personal tutor, who will probably already have helped in preparing your formal proposal. You will hear by October whether your proposal has been accepted, so that you can meet your tutor in December for your first two-hour project tutorial. We have planned for each student to have a further six hours of tutorial time during the year, with the option of another two, and informal communication between tutor and student (by telephone or electronic mail) is strongly encouraged. About £20 is available for each project to pay for essential items, including library searches.

If you are disabled

Because of the wide variety of projects and the emphasis on individual choice, you should have no particular problems with T401 if you have been able to take technology courses at Level 3. There are no recordings of course materials. Please ask your Regional Centre for our booklet *Meeting Your Needs* if you haven't already got it.

Course materials

There are no study texts but you will be sent material including *Study Guidelines*, and an *Information Search Guide* to help you in the conduct of your project and in writing your project reports.

You may need to buy

Books for your own project.

Assessment

You will be required to present three reports during the year.

- An initial report investigating the project background and giving a critical appraisal of relevant literature, defining the project proposal and setting out a detailed project plan (submitted in February).
- An interim report outlining progress made, elaborating on the project plan, and including a draft chapter on the methods of investigation as well as chapter headings for the final report (submitted in June).
- A final written report, submitted at the end of August.

The final project report will be assessed by both your tutor and the internal examiner. You will meet the examiners at a compulsory oral examination. Oral examinations are held at the end of September or the beginning of October, usually in your Regional Centre.

You will not normally be allowed to:

- Resubmit a final report or have another oral examination (i.e. resit T401) if you fail to obtain credit.
- Attempt the same project topic in a later year if you withdraw before completing the course. If exceptional circumstances arise, cases are considered individually.

Awards

This course can count towards either a BA or a BSc degree. It is designated *S*, which means that it can weight your degree towards a BSc.

Professional recognition

This course can in some circumstances help you to gain recognition from professional bodies including the British Computer Society and many engineering institutions. If you intend to use T401 as part of a submission to the Engineering Council for professional recognition and status as a chartered engineer, you are advised to ask for a copy of Recognition Information Leaflet 3.3 *Membership of professional bodies: the professional engineering institutions*.

You can find out more about other professional bodies from our Recognition Information leaflets:

3.4 *Membership of professional bodies: Chartered Institution of Water and Environmental Management*

3.5 *Membership of professional bodies: Institute of Waste Management*

3.7 *Membership of professional bodies: Institute of Acoustics*

3.11 *Membership of professional bodies: other bodies*

You can get these from your Regional Centre.

Study Packs

DEVELOPMENT STUDIES

The following two study packs are the first of a series built round co-published books, including the *Third World Atlas*, and television programmes prepared for the course U208 *Third World development* (described on page 45). The books are available from bookshops and if you already have them you can buy the other study pack materials separately. The twelve television programmes have been recorded on two video cassettes, which are available as a third study pack, *The developing world* (T533) – see below.

TEACHING DEVELOPMENT

This introduction to the teaching of development studies is for a variety of audiences including students aged 16–19, especially those studying for A-levels, and adults pursuing extramural activities in this area. The full study pack includes the textbook *Poverty and Development in the 1990s*, the *Third World Atlas*, two video cassettes, video notes and a study guide. The texts, study guide and map, and video cassettes can also be purchased separately.

Code T531A
Fee £80.91 (inc. £5.91 VAT)
Texts only T531B
Fee £35.00
Study guide and map only T531C
Fee £7.00
Video cassette 1 T531D
Fee £26.44 (inc. £3.94 VAT)
Video cassette 2 T531E
Fee £26.44 (inc. £3.94 VAT)
Available spring 1996, but please check before ordering

WORKING FOR DEVELOPMENT

This pack and its supplements will interest development workers in non-governmental organizations, people who work or intend to work in developing countries, and trainers and educators in development issues. It is designed so that you can study it on your own, but the study guide is organized round themes and activites so that trainers and educators can easily adapt the materials for use in internal training and development education work.

Study pack T532A includes the textbook *Poverty and Development in the 1990s*, the *Third World Atlas*, a study guide, video cassette 1, video notes and a case study. Study pack T532D includes *Poverty and Development in the 1990s*, the *Third World Atlas*, the study guide and case study. Supplement pack T532B includes the study guide, video notes and case study only. The video pack T532C contains video cassette 2. (The video notes in T532A and T532B cover both video cassettes.)

Code T532A
Fee £70.12 (inc. £5.12 VAT)
Supplement pack code T532B
Fee £34.52 (inc. £2.52 VAT)
Video pack code T532C
Fee £26.44 (inc. £3.94 VAT)
Study pack code T532D
Fee £35.00

THE DEVELOPING WORLD

This pack consists of the two videos of television programmes made for the *Third World development* course (U208) and a book of programme notes. It will interest higher and further educational institutions, adult education organizations, teachers and trainers in development education and anyone who wants to learn more about development issues.

Code T533
Fee £53.94 (inc. £3.94 VAT)

LOOKING INTO THE ENVIRONMENT

This pack, presented by the Open University in association with the World Wide Fund for Nature, tackles some of today's most urgent environmental issues. It includes a three-hour video cassette and a book, richly illustrated in full colour, *One World for One Earth: Saving the Environment*. The video cassette's eight programmes have been recorded all over the world:

Valued environments: environmental values
Forest futures
Living with drought
Bangkok: a city speaks
No place to hide
Danish energy
The heat is on
Walk softly on the Earth

One World for One Earth: Saving the Environment, written to complement the programmes, offers a wider view of environmental problems and their relationship to physical and social processes. Its main theme is that, crucial as independent local action is to the solution of problems, sustainable development needs international co-operation if it is to be really effective.

To enable you to get the most out of the pack, an activity booklet suggests a series of questions and activities that explore issues in greater depth. The pack guide offers suggestions for study, notes about the video cassette programmes and a useful environmental glossary.

Code PU771
Fee £39.95 (inc. £2.92 VAT)

The pack includes
Study texts
Video cassette
Discount scheme – see page 1
Looking into the environment is available both from the Open University and from the World Wide Fund for Nature

THE CHANGING COUNTRYSIDE

Britain's countryside, like that of its European neighbours, is undergoing a rapid transformation after a long period of gradual evolution. As technology increases agricultural yields and European Union subsidies are restricted, much of its farmland will no longer be needed and what can be done with it is one of the biggest environmental questions of the next decade. This new development comes on top of long-term social change. Since the war, employment on the land has declined and farm-workers have moved to the towns in search of work. The accessible countryside has increasingly become peopled with commuters, while the more remote and scenically attractive areas have been taken over by a growing number of second-home owners and the retired. These newcomers have brought with them different expectations and requirements of the countryside and their presence is having serious consequences for rural services and amenities and for village life itself. This pack examines the possible outcomes of these developments with the help of three books, a video and two audio cassettes. It also considers the conflicting views of farmers and foresters, environmentalists, conservationists, the leisure industry, developers, planners and rural communities, making comparisons between policies and attitudes in Britain and in countries such as France and Italy. It is a pack for all who live in the countryside and all those who care about rural life as part of their heritage.

Code PD770
Fee £39.95 (inc. £2.92 VAT)

The pack includes
Study texts
Audio and video cassettes
Discount scheme – see page 1

EAST ANGLIAN STUDIES: HISTORY OF THE ENVIRONMENT

The topics covered in the main text include the geological history of the area and the biology and geology of the ice ages; recolonization by plants and animals after the last ice age and the arrival of early man; the origins of the Broads and the history of Fenland; the sheep economy before 1600; the history of wastelands, commons and woodlands; the mediaeval church; environmental controversies and pressures.

The field guides give information about access to sites and explain the biological or archaeological background as well as suggesting activities that can be carried out at each site.

Code PS731
Fee £12.50

The pack includes
Study text
Field guides
Time chart
Discount scheme – see page 1

REMOTE SENSING

This pack is the culmination of several years of research into the educational needs of the remote-sensing community. It explains the principles and practice of using satellites and aircraft to record images, and their application in environmental sciences.

Remote sensing is playing an increasingly important role in monitoring both artificial and natural changes in the environment, and this pack is of proven interest to many people including environmentalists and industrialists. Educators in environmental sciences will find it invaluable for use in residential courses. It has been designed with the needs of scientists and technicians in developing countries very much in mind. The level of the pack is suitable for final-year school students and first year undergraduates who have a basic knowledge of natural sciences but no knowledge of remote sensing. It takes about forty hours of study.

The study text includes eight chapters, a comprehensive glossary of remote-sensing terms and an index. It examines the main social, economic and environmental problems facing the world today; the physical principles you need in order to understand the design of remote-sensing systems and the data they produce; how the human visual system interprets and manipulates images; the operation of remote-sensing detectors; the structure of digital images and an introduction to digital image processing. Two of the chapters develop some of the themes by looking at applications and interpretation of images of atmospheric phenomena, the land surface, oceans, rivers and lakes, natural vegetation, human activities and geology. The study text contains many illustrations, exercises and self-assessment questions. It is accompanied by a full-colour booklet with examples of the applications of remote sensing.

Code PS670
Fee £55

The pack includes
Study text
Colour-plate booklet

RENEWABLE ENERGY RESOURCE PACK FOR TERTIARY EDUCATION

Designed to help academic staff in universities to extend their own teaching programmes, the pack covers solar thermal, solar photovoltaic, hydro, wind, wave, tidal, geothermal and biomass renewable energy sources.

As well as the results of the latest research and development in the world-wide field of renewable energy, the pack presents assessments of renewable energy's potential to meet the future energy needs of the developed and developing world. Costs and resources are estimated, and the pack examines the environmental consequences and costs of using renewable energy sources to supplement other energy sources. The pack includes computer spreadsheets with which you can study renewable energy systems and models. The video cassette and eighty colour slides offer material for lectures, while the user guides suggest ways in which all the materials can best be used in the seminar room or lecture theatre.

Code T521
Fee £150 (inc. £10.95 VAT) for individual lecturers (please ask the Learning Materials Sales Office for form TC05)
£250 (inc. £18.25 VAT) for others

The pack includes
Study text
Video cassette
Spreadsheets
Colour slides
Software and data disks
User guides
Exercises
Reprints of articles and conference papers

PRACTICAL CONSERVATION FOR LAND MANAGERS

The next six entries describe a foundation pack and five habitat packs produced in association with the Nature Conservancy Council and English Nature. The series will be particularly useful to conservation advisers and trainers, farmers, foresters, students, local authority workers, conservation volunteers and others who are keen to improve the conservation of landscape and wildlife.

* The study pack prices below include both study texts and cassettes and are for individual purchasers only. Organizations must buy texts and cassettes separately at the prices shown.

MANAGEMENT PLANNING

Management planning is the foundation pack for the Practical Conservation for Land Managers series. It will reinforce your awareness of the need for conservation and show you how to assess the landscape and wildlife value of an area. It draws attention to the importance of *maintaining* existing valuable habitats and landscape features, *enhancing* poorer sites and *creating* new conservation areas, and stresses the need to manage land for conservation purposes just as actively as for commercial or other purposes

The pack takes about forty hours of study. The main text explains how to assess the present landscape and wildlife value of a site and how to combine this with an assessment of its business aspects; how to draw up a set of conservation objectives; how to choose appropriate management schemes and cost them; and how to prepare a complete management plan. The video cassette illustrates the main problems to do with making conservation management decisions and the solutions being tried by a wide variety of land managers throughout Great Britain. The audio cassette includes interviews with conservation advisers about the work they do and how they cope with their clients' needs, while the two supplementary booklets tell you about helpful organizations and the legislation and regulations related to conservation.

Study pack code P585S
Fee £70.12 (inc. £5.12 VAT)*
Study texts and audio cassette code P585TA
Fee £20.35 (inc. £0.35 VAT)
Video cassette only code P585VS
Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Audio and video cassettes

WOODLANDS

This pack is about the practical steps of managing woodland, from the smallest broad-leaved copse to the largest coniferous forest. It gives you detailed information about assessing sites and making appropriate decisions for the development and implementation of a management plan. The emphasis is on incorporating landscape and wildlife conservation into the primary, often commercial, objectives of timber production, game and recreation. The pack takes about twenty-five hours of study.

Study pack code P586S
Fee £39.91 (inc. £2.91 VAT)*
Study texts only code P586TA
Fee £8.50
Video cassette only code P586VS
Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Video cassette

BOUNDARY HABITATS

This pack is about the practical steps of assessing and managing boundary habitats. These include hedgerows, stone walls, ditches, banks, grass strips, roadside verges, railway lines, green lanes and footpaths; in other words, features that fall between other uses of the land and so are at risk of disturbance by other activities. The pack takes about twenty-five hours of study.

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Study texts only code P587TA
Fee £8.50
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Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Video cassette

WATER AND WETLANDS

This pack deals with the management of wetland habitats from the running waters of streams and rivers to the standing waters of lakes, ponds and ditches and the wet ground of bogs and marshes; the distinctive feature is the presence of water throughout the year. The pack takes about twenty-five hours of study.

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Study text only code P588TA
Fee £8.50
Video cassette only code P588VS
Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Video cassette

GRASSLANDS, HEATHS AND MOORS

Grasslands, heaths and moors form the greatest area of our countryside. They have largely come about as a result of agricultural activities, but they are susceptible to change. This pack looks at management possibilities for calcareous, neutral and acidic grasslands, lowland heaths and upland moors. The pack takes about twenty-five hours of study.

Study pack code P589S
Fee £39.91 (inc. £2.91 VAT)*
Study texts only code P589TA
Fee £8.50
Video cassette only code P589VS
Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Video cassette

URBAN HABITATS

Urban habitats include woodlands, grasslands, ponds and footpaths but are distinctive in their size, the greater recreational use to which they are subjected and the involvement of the local community in their planning and management. This pack examines these special requirements. The pack takes about twenty-five hours of study.

Study pack code P584S
Fee £39.91 (inc. £2.91 VAT)*
Study texts only code P584TA
Fee £8.50
Video cassette only code P584VS
Fee £117.50 (inc. £17.50 VAT)

The pack includes
Study texts
Video cassette

DIGITAL TELECOMMUNICATIONS: SWITCHING

This pack introduces modern digital telecommunication systems, services and techniques through a combination of systems studies, material on basic techniques and theoretical ideas. It will be of interest to engineers, technical managers and scientists engaged in setting up or operating systems in digital telecommunications. With *Digital telecommunications: transmission* (PT629), it will bring you up to date with recent developments. The pack is about telecommunication systems in which software techniques are used to 'switch' digital data between individual time slots on a high-speed link, or individual data packets to particular destinations. Examples of such switched networks include both the public telephone network and specialized data communication networks. Three themes run through the pack: the importance of standards and protocols; the need for statistical techniques to analyse and design telecommunication systems; and the essential role of software in implementing and managing such systems. Practical examples are presented: electronic mail, X.25 packet switching; the OSI reference model; a digital telephone exchange; data communication networks. An offprint booklet contains recent articles on digital telecommunication techniques.

Since information in telecommunication networks is mainly processed electronically, you need some familiarity with electronic signals and circuits though you will not find many electronic circuits described in the packs.

Similarly, and perhaps more importantly, although you are not required to carry out complex mathematical manipulations, the pack does assume that you understand algebraic formulae (including logarithms, exponentials and trigonometric functions), interpret mathematical models, appreciate the purpose of calculus and follow simple mathematical proofs. In both areas – electronics and mathematics – it is less important to have advanced skills than to be comfortable with the subjects; for example you should not be alarmed by an expression like

$$P(r) = \frac{(\varphi\tau)^r}{r!} \exp(-\varphi\tau)$$

Code PT628
Fee £345.95 (inc. £5.95 VAT)
About 100 hours of study

The pack includes
Study texts
Audio cassettes

DIGITAL TELECOMMUNICATIONS: TRANSMISSION

This pack introduces modern digital telecommunication systems, services and techniques through a combination of systems studies, material on basic techniques and theoretical ideas. It will be of interest to engineers, technical managers and scientists engaged in setting up or operating systems in digital telecommunications. With *Digital telecommunications: switching* (PT628) it will bring you up to date with recent developments. The pack is about the nature of the signals used in digital telecommunication systems and the physical characteristics of the channels through which they are transmitted. An introduction dealing with the fundamental properties of digital signals and how they can be modelled is followed by modulation and coding schemes. The effects on signals of transmission through various media, including free space and optical fibre, are considered. The later part of the pack consists of two systems studies: a long-distance optical fibre transmission link, and a study of mobile communication systems, including both satellite and cellular radio approaches. An offprint booklet contains recent articles on digital telecommunication transmission.

You need the same knowledge of electronics and mathematics as for PT628 (described above). It is also assumed that when you begin PT629 you have already studied PT628 or T820 (see below).

Code PT629
Fee £152.63 (inc. £2.63 VAT)
About 100 hours of study

The pack includes
Study texts
Audio cassettes

DIGITAL TELECOMMUNICATION COURSES

The study packs *Digital telecommunications: switching* (PT628) and *Digital telecommunications: transmission* (PT629) contain largely the same material as the Level 3 course T322 *Digital telecommunication* (described on page 47). They also form the basis of two shorter courses, also coded PT628 and PT629, which are presented three times a year, in March, May and November. The fee for each of the shorter courses is at present £425. These courses include personal tuition and assessment and can lead to the award of a statement of course participation. You can get further details by ringing Christine Ladley in our Customer Service Centre (01908 653337 or 653917). There is also an examined version of *Digital telecommunications: switching* which is coded T820. If you complete that course successfully you can count it towards the Postgraduate Diploma in Computing for Commerce and Industry.

Digital telecommunications: switching and *Digital telecommunications: transmission* will be replaced during 1986 by a new pack coded T821. If you would like to know more about it please ask the Learning Materials Sales Office.

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